M. Sc. Physics

Syllabus

AFFILIATED COLLEGES

Program Code: 32C

2026 - 2027 onwards

SCAA Dated 10 / 07 /2026

BHARATHIAR UNIVERSITY

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The M.Sc. program in Physics describes accomplishments that graduates are expected to attain within five to seven years after graduation.	
PEO1	Become employable with necessary skills and knowledge in industry, research, academics, business, etc. and on par with national and international standards.
PEO2	Acquired knowledge in physical concepts will facilitate them to recognize, formulate, examine, explore and implement new innovative ideas for overall societal development.
PEO3	Capable enough to meet challenges as an individual and as a part of team in innovative projects.
PEO4	Will acquire a strong cognitive base by learning diverse physical phenomena and thus lead and execute inter- and multidisciplinary academic/research.
PEO5	Will acquire skills to deliver quality, smart and innovative solutions as young entrepreneurs.
PEO6	Will gain proficiency and elevate themselves as resource persons and consultants in various sectors like Defence/Industrial/Energy/Device fabrication.

Program Specific Outcomes (PSOs)	
After the successful completion of M.Sc. Physics program, the students are expected to	
PSO1	Be a potential graduate with the substantial knowledge and awareness of various subdivision in Physics especially in Classical Mechanics, Quantum Mechanics, Mathematical Physics, Nuclear Physics, Electronics and Materials Science.
PSO2	Be a broad-minded inquisitive & person with helping tendency and ready to take intelligent risks to employ the applications of Physics in areas of demand, need and requirement.
PSO3	Hold competency to clear any competitive exam/test with acquired analytical and technical
PSO4	Be proficient and updated in the usage of contemporary computational tools to explore new challenges/tasks.
PSO5	Be curious and alert always to perceive and experiment so as to arrive at a solution to any challengeable task.
PSO6	Be efficient to employ and apply out-of-the-box results of research findings.
PSO7	Always ready and able enough to fulfill demands of society and nation with technical skills and proficiency.

Program Outcomes (POs)	
On successful completion of the M. Sc. Physics program	
PO1	Comprehend the concepts of basic and advanced physics and provide real world solutions to problems.
PO2	Conceptualize any physics problem with an appropriate models and provide useful and smart solutions.
PO3	Enhance the application feasibility of Physics to other disciplines with better and clear understanding.
PO4	Learn valuable experimental skills to carry out new investigations to develop new, smart materials with unique characteristics.
PO5	Develop computational & software tools by applying the learned concepts in Physics
PO6	Perceive and adopt novel ideas to facilitate better and in-depth understanding of physical processes.
PO7	Capable to provide out-of-box solutions to any challenge in academics, education, research and industry.

BHARATHIAR UNIVERSITY: COIMBATORE 641 046

M. Sc. Physics Curriculum (AFFILIATED COLLEGES – OBE PATTERN)

(For the students admitted during the academic year 2026– 27 onwards)

Course Code	Title of the Course	Credits	Hours/Week		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
	FIRST SEMESTER						
13A	Paper - I Classical Mechanics	4	5	-	25	75	100
13B	Paper - II Mathematical Physics	4	5	-	25	75	100
13C	Paper -III Advanced Computational Physics	4	5	-	25	75	100
	Practical - I General Physics Lab	2	-	5	-	-	-
	Practical - II Electronics Lab	2	-	5	-	-	-
1E	Elective I : 1EA : Non-conventional Energy Resources (Or) 1EB : Nano science & Nanotechnology (Or) 1EC : Industry (4.0)- Robotics, Artificial Intelligence & Information Theory	4	5	-	25	75	100
	Total	20	20	10			400
	SECOND SEMESTER						
23A	Paper - IV Quantum Mechanics	4	4	-	25	75	100
23B	Paper - V Electromagnetic Theory	4	4	-	25	75	100
23C	Paper - VI Advanced Electronics	4	4	-	25	75	100
23D	Paper - VII Astronomy, Astrophysics & Cosmology	4	4	-	25	75	100
23P	Practical- I General Physics Lab	2	-	5	40	60	100
23Q	Practical- II Electronics Lab	2	-	5	40	60	100
2E	Elective II : 2EA : Atmospheric Physics (Or) 2EB : Crystal Growth Methods & Characterization (Or) 2EC : Introduction to Data Analytics	4	4		25	75	100
	Total	24	20	10			700

THIRD SEMESTER							
33A	Paper - VIII Advanced Quantum Mechanics	4	5	-	25	75	100
33B	Paper - IX Thermodynamics and Statistical Mechanics	4	5	-	25	75	100
33C	Paper - X Condensed Matter Physics	4	5	-	25	75	100
33P	Practical- III Advanced Physics Lab – I	2	-	5	20	30	50
33Q	Practical- V Advanced Electronics Lab - I	2	-	5	20	30	50
3E	Elective III : 3EA : Experimental Techniques & Data Analysis (Or) 3EB : Microprocessors & Microcontrollers (Or) 3EC : Problems in Physics	4	5	-	25	75	100
	Health and wellness	1	-	-	25	-	25
	Total	21	20	10			525
FOURTH SEMESTER							
43A	Paper -XI Nuclear and Particle Physics	4	5	-	25	75	100
43B	Paper -XII Atomic and Molecular Spectroscopy	4	5	-	25	75	100
43C	Paper -XIII Laser Optics	4	5	-	25	75	100
43P	Practical- V Advanced Physics Lab – II	4	-	5	20	30	50
43Q	Practical- VI Advanced Electronics Lab - II	4	-	5	20	30	50
47V	Project or Internship	4	-	3	50	150	200
47R	Technical Skills Enhancement Programme - (Self-Study Mode With Presentation and No Written Examination at the End of Semester)	1		2	25	-	25
	Total	25	15	15			625
	Grand Total	90	75	45			2250
ONLINE COURSES							
OOC, SWAYAM, NPTEL, Websites etc.							

CO-SCHOLASTIC COURSES							
ONLINE COURSE							
	SWAYAM - MOOQ,course	2					50
VALUE ADDED COURSES							
	Course I	2					50
	Course2	2					50
CERTIFICATE COURSES							
	Course I	2					50
	Course2	2					50
SWAYAM - MOOC - online course shall be for a duration of at least 4 weeks with at least 2 credits and shall be completed within the third semester (i.e., before the beginning of the fourth semester)							

MARKS DISTRIBUTION (INTERNAL (CIA) AND EXTERNAL)

I – THEORY

TOTAL MARKS	EXTERNAL	INTERNAL	Overall Passing Minimum (Internal +External)
	Max. Marks	Max. Marks	
100	75	25	50

S. No.	Theory – CIA Breakup	
	Maximum Marks	25
1.	CIA Tests I / II & Model Exam – End Semester	15
2.	Assignment	05
3.	Others *	05

*Components for 'others' may include the following:

Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop / Conference Participation, Presentation of Papers in Conferences, Quiz, Report / Content Writing, Seminars, etc.

II – PRACTICALS

TOTAL MARKS	EXTERNAL	INTERNAL	Overall Passing Minimum (Internal + External)
	Max. Marks	Max. Marks	
50 & 100	30 & 60	20 & 40	25 & 50

S. No.	Practical – CIA Breakup	
	Maximum Marks	20 & 40
1.	Model-Choose	10 & 20
2.	Record & Observation	10 & 20

Note: End of Semester Practical Examinations will be of 6 Hours Duration (II,III &IV Semesters)

III – Project/Internship

S. No.	Project/Internship - Marks Breakup	
	Total : 200 Marks	
1.	Internal (Project Work / Internship + Continuous Review)	50
2.	External (Dissertation : 50 marks + Viva-Voce : 50)	150

IV-Technical Skills Enhancement Programme –Self Study Mode

S. No.	Technical Skills Enhancement Programme	
	Total : 25 Marks	
1.	Internal (Seminar / Quiz / Test / Debate / Group Discussion / Presentation)	25

Distribution of Marks & Credits

	Subjects					
	CORE	ELECTIVE	SWAYAM/MOOC	VAC	JOC	TOTAL
MARKS	1950	300	50	100	100	2500
Credits	78	12	02	04	04	100

First Semester

Course code : 13A	Core Paper I	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	CLASSICAL MECHANICS	5	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objective of this course is to familiarize the student to the fundamental concepts of Classical Mechanics, its simplified approach and methods in solving various complex problems thus providing a foundation for the modern understanding of dynamics

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Get familiarity of basic mathematical tools like Variational principle, Lagrangian and Hamiltonian formalism and able to compute the equations of motion.	K2
2	Understand the central force problem, phase space and its various applications	K3
3	Solve problems through canonical transformations and Hamilton's Jacobi technique	K4
4	Acquire knowledge of rigid body dynamics as well as normal mode analysis	K5
5	Understand basic concepts of Relativity theory & Non-linear dynamics	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	VARIATIONAL PRINCIPLE: LAGRANGE'S AND HAMILTON'S EQUATIONS	10 hours

Newton's Three Laws of Motion (Review) – Constraints, Degrees of freedom, Generalized Coordinates and Configuration Space. Variational Principle – Hamilton's Principle – Derivation of Euler-Lagrangian Equation of Motion —- Phase Space — Physical Significance of Hamiltonian - Applications : Lagrangian and Hamilton's Equation of Motion for Simple Pendulum, Linear Harmonic Oscillator and A Charged Particle in Electromagnetic Fields .

Unit II	CENTRAL FORCE AND NON-INERTIAL FRAME	12 hours

Motion in a Central Force Field in Lagrangian Formalism – Reduction of Two Body Problem to the Equivalent One Body Problem – Classification of Orbits for Inverse Square Forces – Virial Theorem – Differential Equation for the Orbits – Two Body Collisions - Classical Scattering in Laboratory and Centre of Mass Frames – Non-inertial Frames – Rotating frame of Reference – Pseudo Forces – Coriolis Force and Effects of Coriolis Force on the Moving Bodies.

Unit III	CANONICAL TRANSFORMATION AND HAMILTON JACOBI METHOD	12 hours

Principle of Least Action : Statement and Proof – Canonical Transformations – Generating Functions and its different forms – Poisson's Bracket – Properties – Angular momentum Algebra – Liouville's Theorem (without Proof) – Hamilton Jacobi method – Harmonic Oscillator Problem – Hamilton's Characteristic Functions — Kepler Problem – Action and Angle Variables – Linear Harmonic Oscillator using Action and Angle Variables.

Unit IV	RIGID BODY AND SMALL OSCILLATIONS	12 hours

Motion of a Rigid Body – Euler Angles – Angular Momentum and Inertia Tensor – Moment of Inertia and Products of Inertia – Principal Axis – Rotational Kinetic Energy - – Free motion of a Symmetric Top – Theory of Small Oscillations – Potential Energy – Stable and Unstable Equilibrium – Eigenvalue Problem – Frequencies of Free Vibrations – Normal Modes – Normal Coordinates.

Unit V	THEORY OF RELATIVITY AND INTRODUCTION TO NON-LINEAR DYNAMICS	12 hours
Introduction to Relativity -Lorentz Transformations – Mass and Energy Equivalence – Relativistic Kinematics - Force in Relativistic Kinematics and Lorentz Transformation of Force – Lagrangian and Hamiltonian in Relativistic Kinematics – Minkowski space – world point and world line –Simple Harmonic Oscillator in One Dimension– Linear Stability Analysis – Classification of Fixed Points.		
Unit VI	CONTEMPORARY ISSUES	2 hours
Expert Lectures, Online Seminars – Webinars		
	Total Lecture Hours	60 hours

Text Book(s)	
1	Classical Mechanics – J. C. Upadhyaya, Himalaya Publishing House, 2012.
2	Classical Mechanics – N. C. Rana and P.S. Joag, Tata McGraw Hill, 2001
Reference Books	
1	Classical Mechanics – H. Goldstein, C.P. Poole and J. Safko, 3rd Edition, Pearson, 2012
2	Classical Mechanics - Douglas Gregory, , Cambridge University press, 2008, 1stedition
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/122/106/122106027/
2	https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/

Course Designed By: BOS-PHYSICS-PG-Team

Mapping with Programme Outcomes(S-Strong, M-Medium, L-Low)

COs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	L	M	M
CO3	S	M	M	L	M	S	M
CO3	S	S	S	L	M	S	M
CO4	S	S	M	L	M	S	M
CO5	S	S	M	L	M	M	M

Course code : 13B	Core Paper II	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	MATHEMATICAL PHYSICS	4	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to make students hone their mathematical skills and get familiarized with the mathematical tools available to approach problems in advanced physics courses.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	understand vector calculus and also able to write operators in different coordinate system	K2
2	apply linear vector space concepts in quantum mechanics	K3
3	understand convergence of infinite series, error analysis and curve fitting	K4
4	evaluate real integrals appearing in science and engineering problems	K5
5	solve differential equations and understand self adjoint operators used in quantum mechanics	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	VECTOR & TENSORS ANALYSIS	10 hours

Line Integral –Surface Integral –Volume Integral- Gauss Divergence Theorem – Stokes Theorem – Green's Theorem- Orthogonal Curvilinear Coordinates-Definition of Linear Vector Space – Linear Independence of vectors and dimensions – Orthonormal set – Introduction of Tensors – Symmetric and Anti Symmetric Tensors – Kronecker Delta symbol – Metric Tensor.

Unit II	INFINITE SERIES & COMPLEX VARIABLES	10 hours

Introduction to Sequence and Series– Geometric Series-Absolute Convergence- Comparison Test –Cauchy Ratio Test – Integral Test – Cauchy's Root Test- Function of a Complex Variables – Analytic Functions – Cauchy Riemann Condition with Proof – Cauchy's Integral Theorem – Cauchy's Integral Formula – Taylor Series – Singularities – Cauchy Residue Theorem.

Unit III	ORDINARY DIFFERENTIAL EQUATION & SPECIAL FUNCTIONS	12 hours

Solutions of Second Order Ordinary Differential Equations with Constant Coefficient- Solution of Differential Equations of – Legendre, Hermite, Laguerre and Bessel Differential Equations – Generating Function, Rodrigues Formula, Recursion Relations, Orthogonality Relations.

Unit IV	FOURIER SERIES & LAPLACE TRANSFORMS	12 hours

Introduction to Fourier Series – Dirichlet's Theorem and Dirichlet's Conditions – Complex Form of Fourier Series – Parseval's identity – Fourier Sine and Cosine Transform of derivatives – applications of Fourier series in forced vibrations -Properties of Fourier Transforms –Fourier Transforms of Derivatives –-Introduction to Laplace Transforms- – Properties of Laplace Transform- Laplace Transform of Derivatives of a function – Convolution Theorem.

Unit V	GREEN'S FUNCTION & GROUP THEORY	12 hours

Introduction to Green's Function- Dirac Delta Distribution- Green's Function for Poisson's Equation– Green's Function for Quantum Mechanical Scattering Problem-Concepts of a Group Theory – Group Multiplication Table – Cyclic Group – Subgroup – Cosets – Homomorphism and Isomorphism – Representation of groups – Reducible and Irreducible Representation.

Unit VI	Contemporary Issues	2 hours
Expert Lectures, Online Seminars – Webinars		
	Total Lecture Hours	60 hours

Text Book(s)	
1	Mathematical Physics with classical Mechanics, Sathya Prakash, Sultan Chand & sons, Edition 2016.
2	Mathematical Physics, H.K Dass, Dr. Rama Verma, Sultan Chand & sons, Edition 2014.
3	Mathematical Physics, B.D Gupta, Vikas Publishing House Private Ltd. Edition 2010.
Reference Books	
1	Advanced Engineering Mathematics – Erwin Kreyszig, Herbert Kreyszig and Edward J. Norminton, John Wiley & Sons, 10th Edition, 2011
2	Mathematical Methods for Physicists (a comprehensive guide) – George B. Arfken and Hans J. Weber and Frank E. Harris, Elsevier Academic Press, 7th Edition, 2013.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/115/106/115106086/
2	https://nptel.ac.in/courses/115/103/115103036/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	L	M	M
CO3	S	M	M	L	M	S	M
CO3	S	S	S	L	M	S	M
CO4	S	S	M	L	M	S	M
CO5	S	S	M	L	M	M	M

Course code : 13C	Core Paper III	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ADVANCED COMPUTATIONAL PHYSICS	5	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objective of this course is to enhance the Numerical and Computational problem solving skills of students by learning advanced techniques as well as computer programming with the help of Mat Lab and Python Programming Language.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand and apply numerical methods to find out solution of algebraic equations	K2
2	Apply various interpolation methods and finite difference concepts.	K3
3	Utilize numerical differentiation and integration methods	K3
4	Familiarize with modern high level programming Language of Mat Lab and Identify/characterize/define a problem of Python	K4
5	Process, analyze and plot data from a variety of physical phenomena and interpret the results with meaning	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	NUMERICAL DIFFERENTIATION	12 hours

Finding Roots of a Polynomial – Bisection Method – Newton Raphson Method – Solution of Ordinary Differential Equation by Euler – Runge Kutta Fourth Order Method for solving first order Ordinary Differential Equations- Partial differential equations: Laplace, wave, and Schrödinger equations.

Unit II	NUMERICAL INTEGRATION	10 hours

Trapezoidal rule – Simpson's 1/3 rule – Simpson's 3/8 rule – Gaussian quadrature method (2 point and 3 point formula) – Giraffe's root square method for solving algebraic equation.

Unit III	MAT LAB FUNDAMENTALS	12 hours

Introduction – Mat Lab Features – Desktop Windows: Command, Workspace, Command History, Array editor and Current Directory – Mat Lab Help and Demos – Mat Lab Functions, Operators and commands, Basic Arithmetic in Mat Lab – Basic Operations with Scalars – Vectors and Arrays – Matrices and Matrix Operations – Complex Numbers – Mat Lab Built – In Functions – Illustrative Examples.

Unit IV	PYTHON FOUNDATIONS FOR COMPUTATIONAL PHYSICS	12 hours

Python basics: interpreter, syntax, variables, data types, control structures- Functions, modules, file I/O and data handling-Graph plotting and visualization with Matplotlib- Basic of Linux for computational work.

Unit V	PYTHON PACKAGES & PROGRAMS	12 hours

Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.-
GUI Programming: Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples. Python programming with IDE-Python Program to print Fibonacci Sequence-Program to print prime numbers in an interval-Factorial of a given number-Program to check whether a given number is positive/negative or zero-Program to find LCM & HCF

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars

	Total Lecture Hours	60 hours
Text Book(s)		
1	Numerical methods in Science and Engineering – M.K. Venkataraman, National Publ. Co. Madras, 1996	
2	Getting Started With Mat Lab –Rudra Pratap, Oxford University Press-New Delhi	
3	Jeeva Jose & P. Sean Lal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Publishers, New Delhi, 2016	
4	Mark Lutz, "Learning Python", 5th edition, Orelly Publication, 2013, ISBN 978- 1449355739	
5	Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009	
6	Jeeva Jose & P. Sean Lal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Publishers, New Delhi, 2016	
Reference Books		
1	Numerical methods using Mat Lab –John Mathews & Kurtis Fink, Prentice Hall, New Jersey 2006	
2	Mat Lab Programming – David Kentucky, Prentice Hall	
3	Wesley J. Chun, "Core Python Applications Programming", 3rd Edition , Pearson Education, 2016	
4	John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_ma33/preview	
2	https://nptel.ac.in/course/103106074/	
3	https://nptel.ac.in/course/122106033/	
Course Designed By: BOS-PHYSICS-PG-Team		

Mapping with Programme outcomes

(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Second Semester

Course code : 23A	Core Paper IV	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	QUANTUM MECHANICS	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to provide a platform for the understanding of the language and formalism of non-relativistic Quantum Mechanics and utilize the Schrodinger Equation in both time-dependent and time-independent modes in solving many real world applications.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Get familiarity with using Dirac notation	K2
2	Apply Schrodinger equations to solve simple problems	K3
3	Learn quantum mechanical angular momentum and spin momentum algebra	K4
4	Compute corrections in energy and wave functions using approximation techniques	K5
5	Integrate several components of the course like quantum states, symmetries, angular momentum etc., in the context of finding solution to the problems in atomic and molecular physics	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	Basic Formalism	8 hours

Postulates of Quantum Mechanics – Max Born Statistical Interpretation of Wave function – Probability Density – Wave function in Position Representation and Momentum Representation – Derivation of Schrodinger Time Independent Wave Equation – Stationary States – Dirac Notation – State Vectors – Hilbert Space – Basis – Orthonormal Basis – Change of Basis – Unitary Transformation – Equation of Motion in Schrodinger Representation – Heisenberg and Dirac Representation.

Unit II	APPLICATIONS OF SCHRODINGER WAVE EQUATIONS	10 hours

Bound State Problems – One Dimensional Infinite Square Well (0,L) – Three Dimensional Infinite Cubic Well – Concept of Degeneracy – One Dimensional Finite Square Well – Potential Step – Square Potential Barrier – Explanation of Alpha Decay – Solution of Linear Harmonic Oscillator by Schrodinger Approach (Differential Equation Method) and Heisenberg Approach (Creation and Annihilation Operator Method) – Central Potential – Hydrogen Atom (qualitative)

Unit III	ANGULAR MOMENTUM ALGEBRA	12 hours

Orbital Angular Momentum Algebra – Spin Angular Momentum Algebra – Pauli Spin Matrices – Eigen Values and Eigen Vector of Pauli Spin Matrices – Properties of Pauli Spin Matrices – Total Angular Momentum Algebra – Complete Set Of Compactable Operators – Commutation Relations of J^2, J_z, J_+, J_- Eigen Values of $J^2, J_z,$ - matrix representation of J^2, J_z, J_+, J_- addition of angular momenta Clebsch-Gordon coefficients and its properties – CG Coefficients for Spin Half systems and Spin One systems.

Unit IV	STATIONARY APPROXIMATION METHODS	12 hours

Time independent Perturbation Theory – Non Degenerate Case – Ground State of Helium Atom – Degenerate Case - Stark Effect in Hydrogen Atom – Variation Method – The Hellmann Feynman Theorem – Estimation of Ground State of Helium Atom – Estimation of Ground State of Deuteron – WKB Approximation – Connection Formula – Validity – Barrier Penetration – Alpha Emission

Unit V	TIME DEPENDENT PERTURBATION THEORY	12 hours
Time Dependent Perturbation Theory – Formalism – Transition Probability – Transition Probability for a Constant Perturbation - Transition into a continuum of final states – Fermi Golden Rule – Transition Probability for a Harmonic Perturbation – Stimulated Emission – Principle of Detailed Balancing – Selection Rules – Rayleigh Scattering – Raman Scattering		
Unit VI	CONTEMPORARY ISSUES	2 hours
Expert Lectures, Online Seminars – Webinars		
	Total Lecture Hours	60 hours

Text Book(s)	
1	Quantum Mechanics – Nouredine Zettili, John Wiley & Sons, Ltd, 2nd Edition, 2009
2	Quantum Mechanics – G. Aruldhas, PHI Learning Private Limited, 2nd Edition, 2009
3	Introduction to Quantum Mechanics – 2nd Edition – David J. Griffiths – Pearson Education International.
Reference Books	
1	Quantum Mechanics – V. Devanathan – Narosa Publishing – New Delhi, 2005
2	Quantum Mechanics – L.I. Schiff – McGraw Hill, 3rd Edition, 1968
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/122/106/122106034/
2	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/
3	Nptel lecture – Quantum Mechanics by Prof. Ajay Ghatak

Course Designed By: BOS-PHYSICS-PG-Team

Mapping with Programme outcomes (S – Strong; M – Medium; L – Low)							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 23B	CORE PAPER V	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ELECTROMAGNETIC THEORY	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to understand thoroughly about matter, charges, their fields and resultant Electric and Magnetic forces and EM Waves.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Get familiarized with concepts of Electric charges at rest in matter and media and Magnetostatics	K2
2	Understand transmission of electromagnetic waves through wave guide.	K3
3	Learn about Dielectric Polarization and Maxwell's Equations of EM waves	K4
4	Derive formulas to experimentally measurable quantities (like electric and magnetic susceptibility)	K5
5	Evaluate electric, magnetic fields, electric potential and vector potentials for point charge and radiation emitted by charges in motion	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	ELECTROSTATICS	8 hours

Coulomb's law-Gauss law- differential and integral representation – Application of Gauss' law-Electric field- Electrostatic potential- Method of images – Multiple expansions-Electrostatic Boundary conditions-Electrostatic Energy

Unit II	ELECTROSTATICS IN MACROSCOPIC MEDIA	8 hours

Potential and Field due to an Electric Dipole-Dielectric Polarization-External Field of a Dielectric Medium-Polarization and its types -Gauss' Theorem in a Dielectric-Electric Displacement Vector (D) –Linear Dielectrics-Relations connecting Electric Susceptibility Polarization vector (P) – Relation between Displacement vector and Dielectric Constant-Boundary Conditions of Field Vectors-Molecular Field-Clausius-Mosotti Relation for Non-Polar Molecules.

Unit III	MAGNETOSTATICS	10 hours

Biot-Savart Law-Force on a current carrying conductor - Lorentz Force law-Definition of B-Divergence and Curl of B-Magnetic Scalar Potential (derivation of expression only) Equivalence of Small Current Loop and Magnetic Dipole-Magnetic Vector Potential(derivation of expression only)- Ampere's Circuital Law and its application.

Unit IV	ELECTROMAGNETICS	16 hours

Faradays' Law in Differential Form -Equation of Continuity-Displacement Current-Derivation of Maxwell's Equations-Maxwell's equation in Free space & Conductors-Physical Significance-Poynting Vector-Momentum in EM field-Electro Magnetic Potentials Maxwell's Equations in terms of EM Potentials-Lorentz Gauge-Coulomb Gauge.

Unit V	RELATIVISTIC ELECTRODYNAMICS	16 hours

Four Vectors-Lorentz Transformation of space and time in four vector form-Transformation relation for charge and current densities-Transformations of Electromagnetic potential A and –Lorentz condition in covariant form-Invariance (or) Maxwell's field equation in terms of four vectors-Electromagnetic field tensor-Lorentz force in covariant form – Field Tensor

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars

Total Lecture Hours	60 hours

Text Book(s)	
1	Electromagnetic Theory & Electrodynamics-Satyaprakash-Kedarnath Ramnath & Co.-Meerut
2	Electromagnetic Theory – Chopra & Agarwal-Nath & Co.1984
3	Introduction to Electrodynamics – David J Griffiths, Pearson Publications, 4th Edition-2012
3	Electrodynamics-Gupta, Kumar & Singh –Pragati Prakashan-Meerut 1600
4	Principles of Electrodynamics-M. Schwartz McGraw Hill
5	Introduction to EM Fields & Waves-Carson & Lorrain
Reference Books	
1	Classical Electrodynamics – J. D. Jackson, Wiley Eastern, 3rd Edition, 2004
2	Classical Electrodynamics – W. Greiner, Spring Verlag New York, Inc. , 1998
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/122/106/122106034/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	S	M	S
CO2	S	S	S	L	M	M	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	M	M	M	S

Course code : 23C	Core Paper VI	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ADVANCED ELECTRONICS	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objective of this course is to make the students aware of Semiconductor Analog/Digital Device Characteristics and their applications in day-today lives.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the principle and operation of semiconductor devices	K2
2	Learn the characteristics of an Op-amp and it's applications	K2, K3
3	Recognize the importance of signal processing devices like Radars/Television	K4
4	Acquire information on Communication related electronic concepts & Antennas	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	SEMICONDUCTOR DEVICES AND IC FABRICATION	12 hours

Semiconductor Diodes – Characteristics –Ideal Diode – Clipper and clamper circuits. Special diodes: Zener, Schottky and Tunnel diodes - Applications – Junction transistors –JFET, MOSFET, UJT and SCR – applications – Principle of Integrated Circuits – Fabrication process – Linear and Digital Integrated Circuits.

Unit II	OPERATIONAL AMPLIFIER	12 hours

Op Amp characteristics – DC & AC characteristics – Frequency Response - Parameters of an Op Amp – Adder – Subtractor – Sign Changer – Scale Changer – Phase Shifter – Differential Amplifier – Integrator – Differentiator – Analog Computer Setup to Solve Linear Simultaneous Equations – Differential Equations in Physics – Logarithmic & Exponential Amplifiers – Active Filters (Mathematical derivations)

Unit III	SIGNAL PROCESSING & DATA ACQUISITION	12 hours

Wave Form Generators and Wave Shaping Circuits – Sinusoidal Oscillators – Phase Shift Oscillator – Wein Bridge Oscillator – Crystal Oscillator – Multivibrators, Comparators – Schmitt Trigger - Square Wave & Triangular Wave Generators – Pulse Generators – IC 555 Timer and its Application – Signal and Signal Processing – Analog Multiplexer and De-multiplexer – D/A Converters – A/D Converters.

Unit IV	RADAR / TELEVISION / MICROWAVES	12 hours

Elements of a Radar System-Radar Equation-Radar Performance Factors-Radar Transmitting Systems- Radar Antennas-Duplexers - Radar Receivers and Indicators – Pulsed Systems- Colour TV Transmission and Reception. Microwaves: Generation – Multi cavity Klystron-Reflex Klystron – Magnetron – Travelling Wave Tubes (TWT) – MASER – Gunn Diode.

Unit V	COMMUNICATION ELECTRONICS	10 hours

Analog and Digital Signals - Modulation - Types - AM modulation theory – Frequency spectrum of the AM wave – Representation of AM – Power relations in the AM wave – Generation of AM – Basic requirements- Description of frequency and phase modulation – Mathematical representation of FM – Frequency spectrum of FM wave - Antennas & Wave Propagation : Terms and Definitions – Effect of Ground– Grounded λ/4 – Ungrounded antenna-Antenna Arrays-Broadside and End Side Arrays-Antenna Gain- Directional High Frequency Antennas – Sky Wave Propagation – Ionosphere- Eccles & Larmor Theory-Magneto Ionic Theory-Ground Wave Propagation

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars

	Total Lecture Hours	60 hours

Text Book(s)	
1	Electronic Communication System-George Kennedy & Davis –Tata McGraw Hill 4th edition1989
2	Electronics Devices and circuits– Sanjeev Gupta & Santhosh Gupta, Dhanpat Rai Publications.
3	Microelectronics, Millman & Grabel, McGraw Hill, Second edition (2017)
4	Digital Principles and Applications, Malvino & Leach, McGrawHill, Seventh edition (2011)
Reference Books	
1	Principles of Communication Systems-Taub Schilling-TMH 1986
2	Communication Systems-Simon Haykin-John Wiley & Sons 2005
3	Integrated Electronics, Millman & Halkias, Tata McGraw Hill, 17th Reprint (2000)
4	Electronics Principles & Applications, A.B. Bhattacharya New Central Book Agency (P) Ltd., Kolkata (2007)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/course.html/electronics/operational amplifier
2	https://nptel.ac.in/course.html/digital circuits/
3	http://nptel.ac.in/courses/108/101/108101112/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	L	M	S	M
CO2	S	S	M	L	S	M	S
CO3	S	M	S	S	M	M	M
CO4	M	S	L	L	S	M	M
CO5	S	S	S	M	M	M	M

Course code : 23D	Core Paper VII	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ASTRONOMY, ASTROPHYSICS AND COSMOLOGY	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to familiarize the student about the beauty of our magnificent universe and its various portions through understanding of the fields of Astronomy, Astrophysics and Cosmology

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Comprehend the multitude of celestial objects such as stars, Galaxies, planets, dwarf planets, satellites Red Giants, Super Nova and Black Holes	K3
2	Describe the classification and composition of stars, stellar evolution, interstellar matter & galaxies	K5
3	Learn theoretical and practical aspects of modern observational astronomy and astrophysics.	K4
4	Understand the theories of Creation like Big Bang and Steady State Theory	K5
5	Link theoretical concepts with observational evidence like Hubble's Law and the fate of the Universe	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	HISTORY OF ASTRONOMY	10 hours

History of Astronomy – Ptolemy's Geocentric Universe – Copernicus Heliocentric Universe – Tycho Brahe and Galileo's Observations – Kepler's Laws of Planetary Motion – Newtonian Concept of Gravity – Highlights of Einstein's Special and General Theory of Relativity – Curved Space Time – Evidence of Curved Space Time – Bending of Light – Time Dilation

Unit II	STARS & GALAXIES	12 hours

Stars and Galaxies – Distances – Trigonometric Parallax – Inverse Square Law- Magnitude of Stars – Apparent & Absolute Magnitude and Luminosity – Color and Temperature – Composition of Stars – Velocity, Mass and Sizes– Types of Stars – Temperature Dependence – Spectral Types – Hertzsprung-Russell (HR) Diagram – Spectroscopic Parallax

Unit III	LIFE AND DEATH OF STARS	12hours

Stellar Evolution - Mass Dependence – Giant Molecular Cloud – Proto star-Main Sequence Star – Sub giant, Red Giant, Supergiant – Core Fusion – Planetary Nebula (Or) Supernova – White Dwarfs – Neutron Stars – Pulsars – Black Holes – Detecting Black Holes-The Sun- Its Size and Composition- Sun's Interior Zones – Sun's Surface –Photosphere-Chromospheres – Corona – Sun's Power Source-Fusion Reaction Mechanism

Unit IV	COSMOLOGY – I	12 hours

Introduction to Cosmology – Basic Observations and implications – Olber's Paradox – Expanding Universe – Gravitational Red shift – Doppler Effect – Hubble's Law and the age of Universe – Cosmological Principle – The Perfect Cosmological Principle – Observation and interpretation

Unit V	COSMOLOGY – II	12 hours

Fate of the Universe – Dependence on Mass (Curvature of Space) – Critical density –Open Universe – Closed Universe – Homogenous and Isotropic - Freidman –Robertson – Walker Universes – Deriving the Geometry of the Universe from the Background Radiation –Flatness Problem –Horizon Problem – Inflation and its effect on the universe – The Cosmological Constant.

Unit VI	Contemporary Issues	2 hours

Expert Lectures, Online Seminars – Webinars

	Total Lecture Hours	60 hours
Text Book(s)		
1	The Life and Death of Stars, Kenneth R. Lang	
2	Physical Foundations of cosmology, Viatcheslav Mukhanov.	
Reference Books		
1	Lectures on Astronomy, Astrophysics, And Cosmology, Luis A. Anchordoqu	
2	Lecture Notes of Department of Physics, University of Wisconsin-Milwaukee	
3	An Introduction to Planetary Physics, Kaula.W.M	
4	Astrophysics of the Solar System, K. D. Abhayankar	
5	Astrophysics of the Sun, Harold Zirin.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://nptel.ac.in/courses/115/105/115105046/	
2	http://www.nptelvideos.in/2012/12/astrophysics-cosmology.html	
3	https://onlinecourses.swayam2.ac.in/arp19_ap73/preview	
Course Designed By: BOS-PHYSICS-PG-Team		

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 23P	PRACTICAL I	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	GENERAL PHYSICS LAB (Examination of 6 Hours Duration at the end of Second Semester)	0	0	5	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Develop experimental physics skills and analyze the results with theoretical calculations.	K2
2	Utilize Computational Mat Lab Programing skills in problem solving and data representation	K3
3	Become a skillful experimental physicist	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S. No.-	**PRACTICAL I - GENERAL PHYSICS** **(Examination at the end of Second Semester)** **LIST OF EXPERIMENTS - (Any Twelve Experiments)**
1	Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes – Cornu's Method.
2	Determination of Young's Modulus - Elliptical Fringes-Cornu's Method.
3	Determination of Thickness of thin Wire by Air Wedge method.
4	Determination of Thickness of thin film - Michelson Interferometer.
5	Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility.
6	Determination of Solar Cell characteristics and Efficiency.
7	Determination of Viscosity of the given liquid - Meyer's disc.
8	Thermistor - Temperature Coefficient and Band Gap Energy Determination.
9	Determination of e/m by Millikan's Oil Drop Method.
10	Determination of Stefan's Constant.
11	Specific Heat of a Liquid - Ferguson's Method.
12	He -Ne Laser - Measurement of Wavelength using reflectance grating.
13	Determination of Thickness of very thin wire using -He Ne Laser.
14	Measurement of wavelength of Diode Laser / He - Ne Laser using Diffraction grating.
15	Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser.
16	Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source.
17	Determination of Refractive index of liquids using diode Laser/ He - Ne Laser
18	Determination of Thickness of air film. - Solar spectrum - Hartmann's formula. Edser and Butler fringes.
19	Geiger Muller Counter - Characteristics, inverse square law and absorption coefficient and Determination of Half Life period of radioactive element.
20	Arc spectrum – Iron / Molecular spectra -AIO band.
21	Determination of Polarisability of liquids using spectrometer.
22	Determination of Thickness of the thin wire by diffraction using spectrometer.
23	Miscibility measurements using ultrasonic diffraction method.

24	MATLAB Programming – Roots of a Quadratic Equation & Solution of a System of Linear Equations.
25	MAT LAB Programming- Newton -Raphson Method.
26	MAT LAB Programming- Mean, Median Mode & Standard Deviation.
27	MAT LAB Programming- Curve Fitting & Linear Interpolation.
28	MATLAB Programming - Matrix Summation, Subtraction and Multiplication.
29	MATLAB Programming- Matrix Inversion and Solution of Simultaneous Equations.
30	MATLAB Programming- Solution of Ordinary Differential Equations - First Order.

Course Designed By: BOS-PHYSICS-PG-Team

Course code : 23Q	PRACTICAL II	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Applied Science	ELECTRONICS LAB (Examination of 6 Hours Duration at the end of Second Semester)	0	0	5	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Acquire hands-on knowledge on usage of semiconductor devices and Operational Amplifiers	K2
2	Acquire valuable laboratory skills to construct multi-purpose electronic devices	K3
3	Design and develop electronic circuits as well as test the functioning of these circuits	K5
4	Become a skilful circuit Designer and thus enhance his employability/entrepreneurial skills	K3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S.No.	**PRACTICAL II-ELECTRONICS** **(Examination at the end of Second Semester)** **LIST OF EXPERIMENTS -Any Fifteen Experiments**
1	Design of Regulated and Dual Power Supply and Construction using fixed voltage regulator IC 723
2	Op Amp - Determination of Parameters
3	Op Amp - Construction of Sign Changer, Scale Changer, Adder and Subtractor.
4	Op Amp - Construction of differentiator and integrator circuit using
5	Op Amp - A.C. Amplifier - Inverting, Non-Inverting, Voltage Follower
6	Construction of Basic Logic Gates using Digital IC's
7	Op Amp - Design of Differential Amplifier
8	Solving simultaneous equations - IC 741 / IC LM324
9	Design of Wave Form Generators- using Op Amp and Timer 555
10	Design of UJT Relaxation Oscillator
11	Design of Schmitt Trigger using discrete components and Op Amp/Timer 555
12	Op Amp - Design of Active Filters
13	Construction of Half Subtractor and Full Subtractor using NAND gates
14	Construction of Phase shift oscillator circuit using transistor and its performance study
15	IC 7490 as scalar and seven segment display using IC7447
16	Construction of Multiplexer and Demultiplexer using ICs.
17	Study of binary up/ down counters - IC 7476 / IC7473
18	Construction of pulse generator using the IC 555 - Application as frequency divider
19	BCD to Excess 3 and Excess 3 to BCD code conversion
20	Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp.
21	Op Amp – Construction of low pass and high pass filter circuits and study its output performance.
22	Construction of a two stage RC coupled amplifier and study its frequency response.
23	Construction of a FET amplifier with common source configuration.

24	Construction of Op-Amp-4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type)
25	Construction of pulse generator using the IC 741 - application as frequency divider
26	Construction of square wave and Triangular wave generator using IC 741
27	V-I Characteristics of different colors of LED
28	Construction of Schmidt trigger circuit using IC 741 for a given hysteresis-application as squarer.
29	Study of R-S, clocked R-Sand D-Flip flop using NAND gates
30	Study of Binary to Gray and Gray to Binary code conversion
31	Mat Lab Programming - Diode-Forward Characteristics Plot & Load Line Plot-Estimation of Operating Point
32	Mat Lab Programming - Charging of Capacitor in an RC Circuit with three Time Constants
33	Mat Lab Programming - Plot of Voltage and Current of RLC Circuit Under Steady State Conditions.
34	Mat Lab Programming- NPN Transistor - Plotting Input & Output Characteristics
35	Mat Lab Programming -Full Wave Rectifier -Determination (a) Peak -to -Peak Value of Ripple Voltage, (b) DC Output Voltage (c) Discharge time of the Capacitor (d) Period of Ripple Voltage.
36	Mat Lab Programming - Determination of hole concentration in an N-type extrinsic semiconductor
37	Mat Lab Programming - PN Junction diode plot of junction potential versus source voltage.
38	Mat Lab Programming - Plot of breakdown voltage of a PN Junction diode
39	Mat Lab Programming – determination of poles, zeros and frequency response of a non-inverting Op-Amp
40	Mat Lab Programming – Frequency Response of a Low Pass Op-Amp Filter Circuit

Course Designed By: BOS-PHYSICS-PG-Team

Third Semester

Course code : 33A	Core Paper VIII	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ADVANCED QUANTUM MECHANICS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to impart knowledge of advanced quantum mechanics for solving relevant physical problems.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Apply concepts of QM to real world microscopic problems like scattering & Atomic Structure	K2
2	Utilize Schrodinger equation and to apply semi-classical method to treat atom field interactions.	K3
3	Understand Quantum Mechanical relativistic equations namely Klein-Gordon & Dirac's Equations	K4
4	Learn the concepts of semi-classical treatment of radiation and thus understand QM Field theory	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	SCATTERING THEORY	8 hours

Scattering Amplitude-Expression in terms of Green's Function-Born Approximation and its Validity- Partial Wave Analysis-Phase Shifts-Scattering by Coulomb and Yukawa Potential

Unit II	APPLICATION TO ATOMIC STRUCTURE	12 hours

Identical Particles – constructing symmetric and antisymmetric wave functions – Slater determinant – Pauli's Exclusion principle – Central Field Approximation – Thomas Fermi Model – Hartree's Self Consistent Model – Hartree Fock Equation – Alkali Atoms – Doublet Separation – Intensities

Unit III	RELATIVISTIC WAVE EQUATION	12 hours

Klein Gordon Equation – Plane Wave Equation – Charge and Current Density – Application to the study of Hydrogen Like Atoms – Dirac Relativistic Equation for a Free Particle – Dirac Matrices – Dirac Equation in Electromagnetic Field – Negative Energy States

Unit IV	THEORY OF RADIATION (SEMI CLASSICAL TREATMENT)	12 hours

Einstein's Coefficients – Spontaneous and Induced Emission of Radiation from Semi Classical Theory – Radiation Field as an Assembly of Oscillators – Interaction with Atoms – Emission and Absorption Rates – Density Matrix and its Applications

Unit V	INTRODUCTION TO QUANTUM FIELD THEORY	14 hours

Elements of Quantum Field Theory – Review of Classical Field Theory – Lagrangian and Hamiltonian Formalism – Classical Fields – Quantization of the Fields – Schrodinger Fields – Quantization – Quantization into Bosons – Quantization into Fermions – Relativistic Fields – Scalar Fields – One Component Real Field – Fourier Decomposition – Quantization of Scalar Fields – Ground State and Normal Ordering – Basic Idea of Dirac Fields (no derivation – only qualitative discussion)

Unit VI	Contemporary Issues	2 hours

Expert Lectures, Online Seminars – Webinars

	Total Lecture Hours	60 hours

Text Book(s)

1	Quantum Mechanics –Nouredine Zettili, John Wiley & Sons, Ltd, 2nd Edition, 2009

2	Relativistic Quantum Mechanics and Quantum field Theory – V. Devanathan –Alpha Science International Ltd., Oxford, UK
Reference Books	
1	Quantum Mechanics –G. Aruldhas, PHI Learning Private Limited, 2nd Edition, 2009
2	Quantum Mechanics – L.I. Schiff – McGraw Hill, 3rd Edition, 1968
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/122/106/122106034/
2	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes (S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 33B	CORE PAPER IX	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	THERMODYNAMICS & STATISTICAL MECHANICS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to learn the fundamentals of Heat & Thermodynamics and the importance of Classical and Quantum Statistical Physics in the description of macro and microscopic energy systems.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Understand the important concept of thermodynamics and its relation to statistical physics	K2
2	Apply the concepts of thermodynamics to study relationship between ensembles, microstates and macrostates and probability	K3
3	Analyze and evaluate partition function and compute thermodynamics relations	K4 K5
4	Calculate partition function and compute thermodynamics relations	K5
5	Understand the applications of thermodynamics to magnetism, black body radiation etc.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	THERMODYNAMICS AND RADIATION	10 hours

Introduction – First law of thermodynamics – Second law of thermodynamics – entropy – entropy disorder – Maxwell's thermodynamic potentials and reciprocity relations – thermodynamic equilibrium – chemical potential – black body radiation – Planck's radiation law.

Unit II	MICRO CANONICAL, CANONICAL & GRAND CANONICAL ENSEMBLE	12 hours

Phase space - volume in phase space - number of phase cells in a given energy range of harmonic oscillator - number of phase cell in a given energy range of 3 dimensional free particle - concept of ensemble - micro canonical ensemble - canonical ensemble- grand canonical ensemble - density distribution in phase space - Liouville's theorem- principle of equal apriori probabilities - statistical equilibrium - thermal equilibrium - mechanical equilibrium - particle equilibrium - connection between statistical and thermodynamic quantities.

Unit III	CLASSICAL STATISTICS	12 hours

Microstates and Macro states - Classical Maxwell Boltzmann distribution law- Evaluation of constants (α and β) - Maxwell's law of Distribution of velocities - Principle of equipartition of energy - Connection between the partition function and thermodynamic quantities – Boltzmann's entropy relation – Perfect gas in micro canonical Ensembles - Gibbs paradox – Partition function and its correlation with thermodynamics quantities - Partition functions and its properties – Comparison of ensembles.

Unit IV	QUANTUM STATISTICS	12 hours

Indistinguishability and quantum statistics – Statistical weight and a priori probability- Identical particles and symmetry requirements – Bose Einstein' Statistics (BE) – Fermi Dirac Statistics (FD) –Maxwell Boltzmann's statistics (MB) – Comparison of M-B, B-E, and F-D statistics – Thermodynamic interpretation of parameters (α and β) – Thermodynamic properties of diatomic molecules – Specific heat of solids: Dulong and Pettit's law – Einstein's Theory – Debye theory.

Unit V	APPLICATION OF QUANTUM STATISTICS	12 hours

Ideal Bose Einstein gas: Energy and pressure – Gas Degeneracy – Bose Einstein condensation – Thermal properties of Bose Einstein gas – Liquid helium - Ideal Fermi- Dirac gas: Energy and pressure of ideal Fermi Dirac gas – Weak degeneracy – Strong degeneracy at T = 0 K - Fermi energy - Fermi temperature - Thermodynamic functions of degenerate Fermi Dirac gas – Electron gas – Free electron model and electronic emission.		
Unit VI	CONTEMPORARY ISSUES	2 hours
Expert Lectures, Online Seminars – Webinars		
	Total Lecture Hours	60 hours

Text Book(s)	
1	Statistical Mechanics: A Textbook – S. L. Gupta and V. Kumar, Pragati Prakashan Publication, 20th Edition, 2003.
2	An Introductory Course of Statistical Mechanics, P.B. Pal, Narosa Publishing House, 2008
3	Fundamentals of Statistical Mechanics – B. B. Laud, New Age Internationa Publishers – 2nd Edition 2018
4	An introduction to Thermodynamic and Statistical Mechanics, Keith Stowe, Cambridge University Press, 2nd Edition, 2013
5	Elements of Statistical Mechanics, Kamal Singh & S.P. Singh, S. Chand & Company, 2019
Reference Books	
1	Statistical Mechanics An Elementary Outline, Avijit Lahiri, University Press, Hyderabad 2002
2	Thermodynamic and Statistical Mechanics (Lectures on the theoretical physics), Arnold Sommerfeld, Levant Books, Kolkatta, 2005
3.	Fried, (2010), Fundamentals of Statistical Mechanics and Thermal Physics – McGraw Hill Pub., New Delhi.
4	Keiser Huang, (2008), Fundamentals of Statistical Mechanics – Wiley, India.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://www.grc.nasa.gov/www/k-12/airplane/thermo.html
2	https://ocw.mit.edu/courses/physics/8-333-statistical-mechanics-i-statistical-mechanics-of-particlesfall-013/lecture-notes/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes (S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	S	S	S	L	S	S	S
CO3	S	S	S	L	M	S	S
CO4	S	S	S	L	M	S	M
CO5	M	S	M	L	M	M	M

Course code : 33C	CORE PAPER X	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	CONDENSED MATTER PHYSICS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to make students aware of the concepts like crystal structure, Thermal Conductivity, Semiconductors and material theories of Magnetism, Electricity, Superconductivity and related phenomena.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand Crystal structure, symmetry and lattice theory and their relationships	K1
2	Apply and Analyze concepts of condensed matter to evaluate thermal conductivity/heat capacity	K5
3	Acquire knowledge of the behaviour of electrons in solids based on classical and quantum theories and to become familiar with the different types of magnetism and magnetism based phenomenon	K2
4	To develop an understanding of the dielectric properties and ordering of dipoles in solid matter and to get Familiarized with the different parameters associated with theory of superconductivity	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	CRYSTAL STRUCTURE	12 hours

Crystal classes and system – 2D, 3D lattices – Bravais lattices – Point groups – Space groups – Reciprocal lattice – Ewald's sphere construction – Braggs law – Atomic scattering factor – Diffraction – Structure factor – Experimental techniques – Laue, Powder, Rotation methods – Bonding of common crystal structures – NaCl, CsCl, ZnS and Diamond – Packing density – hcp, ccp,- random stacking and polytypism

Unit II	LATTICE VIBRATIONS AND THERMAL PROPERTIES	12 hours

Vibration of monoatomic lattices – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – Inelastic scattering of neutrons by phonons – Lattice heat capacity – Einstein model – Density of modes in 1D & 3D – Debye model of the lattice heat capacity – Thermal conductivity – Umklapp process

Unit III	FREE ELECTRON THEORY, ENERGY BANDS AND SEMICONDUCTOR CRYSTALS	12 hours

Energy levels and density of orbitals – FD distribution – Free electron gas in 3D – Heat capacity of the e- gas – Electrical conductivity and Ohms law – Motion in magnetic fields – Hall effect – Thermal conductivity of metals – Nearly free electron model – Electron in a periodic potential – Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration

Unit IV	DIAMAGNETISM, PARAMAGNETISM, FERROMAGNETISM AND ANTI FERROMAGNETISM	10 hours

Langevin classical theory of Diamagnetism and paramagnetism – Weiss theory – Quantum theory of paramagnetism– Demagnetization of a paramagnetic salt – Paramagnetic susceptibility of conduction e- – Hund's rules – Ferromagnetic order – Curie point and the exchange integral – Temperature dependence of saturation magnetization – Magnons – Anti ferro magnetic order – Ferromagnetic domains – Origin of domains – Coercive force and hysteresis.

Unit V	DIELECTRICS, FERROELECTRICS AND SUPERCONDUCTIVITY	12 hours

Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability – Clausius-Mossotti equation – Polarization catastrophe – Ferroelectric domains– Occurrence of Superconductivity – Meissner effect – London equation – Coherence length – BCS theory – Flux quantization – Type I and Type II Superconductors – Josephson superconductor tunneling – DC and AC Josephson effect – SQUID – Applications of superconductors

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars

Total Lecture hours	60 hours

Text Book(s)	
1	C. Kittel, Introduction to Solid State Physics, 5th Ed. (Wiley Eastern, New Delhi,1977)
2	N. W. Ashcrof and N. D. Mermin, Solid State Physics (International Edition, Philadelphia, 1976)
3	J. S. Blakemore, Solid State Physics, Second Edition (Cambridge University Press, Cambridge, London, 1974)
4	A. J. Dekker, Solid State Physics (Mac Millan, Madras, 1971)
Reference Books	
1	M. M. Woolfson, An Introduction to X-ray Crystallography (Cambridge University Press, Cambridge, 1991)
2	T. P. Sheahen, Introduction to High-Temperature Superconductors (Plenum press, New York, 1994)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/113/104/113104014/
2	https://www.udemy.com/course/physics-intro-to-electricity-magnetism/
4	https://nptel.ac.in/courses/115/104/115104088/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme Outcomes (S – Strong; M – Medium; L – Low)							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	L	S	M	M	M	S
CO3	L	S	S	M	M	S	L
CO3	M	S	S	L	M	M	S
CO4	L	M	M	S	S	M	S
CO5	S	S	M	L	M	M	S

Course code : 33P	PRACTICAL - V	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ADVANCED PHYSICS LAB - I (Examination of 6 Hours Duration at the end of Third Semester)	0	0	5	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Develop experimental physics skills and analyze the results with theoretical calculations.	K2
2	Utilize Computational Mat Lab & Python Programing skills in problem solving and data representation	K3
3	Become a skillful experimental physicist	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S.No.	LIST OF EXPERIMENTS (Any SIX Experiments)
1	Determination of prominent spectral line wavelengths - Arc Spectra-CDS-Copper, Iron& Brass.
2	Determination of Compressibility of a Liquid-Ultrasonic Method.
3	GM counter - Feather's analysis: Range of Beta rays.
4	Measurement of Susceptibility of liquid - Quincke's method.
5	Measurement of Dielectricity - Microwave test bench.
6	Kelvin's Double Bridge-Determination of Very Low Resistance & Temperature Coefficient of Resistance.
7	Measurement of Magnetic Susceptibility - Guoy's method.
8	B-H curve using CRO.
9	Mat LabProgramming-Numerical simulation of Wave-Functions of Simple Harmonic Oscillator.
10	Mat Lab Programming-Simulation of Wave Functions for a Particle in Critical Box.
11	Mat Lab Programming-Double Integration.
12	Mat Lab Programming-Radioactive Decay.
13	Python Programming: Time Evolution of Driven Pendulum.
14	Python Programming: Find the factorial of a Number.

Course Designed By: BOS-PHYSICS-PG-Team

Course code : 33Q	PRACTICAL - VI	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ADVANCED ELECTRONICS LAB - I (Examination of 6 Hours Duration at the end of Third Semester)	0	0	5	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Utilize operational amplifiers & Microprocessors to build circuits to carry out various tasks	K2
2	Acquire valuable laboratory skills to construct multi-purpose electronic devices	K3
3	Design and develop electronic circuits as well as test/troubleshoot the functioning of these circuits	K5
4	Become a skilful circuit Designer and thus enhance his employability/entrepreneurial skills	K3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S. No.	LIST OF EXPERIMENTS (Any SIX Experiments)
1	Op-Amp: Simultaneous Addition & Subtraction
2	Op-Amp: Instrumentation Amplifier-Temperature Measurement
3	Op-Amp: Circuits Using Diodes-Half Wave, Full Wave, Clipper (Positive & Negative), Clamper (Positive & Negative).
4	Op-Amp: Log and Antilog Amplifier
5	Op-Amp: Voltage to Current and Current to Voltage Converter
6	Digital to Analog Converters-Binary Weighted and Ladder Methods (Any one Method)
7	Microprocessor: LED Interfacing Name Display (rolling)
8	Microprocessor: Stepper Motor Interfacing
9	Microprocessor: ADC Interface-Wave Form Generation
10	Microprocessor: Musical Tone Generator Interface
11	Microcontroller: DC motor control
12	Python Programming : Conversion of Decimal Numbers to Binary, Octal & Hexadecimal
13	Python Programming : Checking whether a given Number is Even or Not/Positive, Negative or Zero
14	Python Programming : Printing the Fibonacci Sequence

Course Designed By: BOS-PHYSICS-PG-Team

Fourth Semester

Course code : 43A	Core Paper XI	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	NUCLEAR & PARTICLE PHYSICS	5	0	0	4
		SEMESTER IV			
		Syllabus Version 2026-2027			

The main objectives of this course is to provide the basics of Nuclear Structure, Models, Reactions and to the complex micro world of High energy Nuclear Particle Physics.

Expected Course Outcomes:

On the successful completion of the course, students

1	Understand the concepts in nuclear and particle physics.	K2
2	Apply conservation principles to determine the type of reaction taking place	K5
3	Analyze the properties of stable nucleus and explore different types of nuclear models	K3
4	Evaluate the properties of stable nucleus and explore different types of nuclear models	K5
5	Acquire Understanding of the classification of high energy nuclear particles at the subatomic level.	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

UNIT I	NUCLEAR STRUCTURE	10 hours

Distribution of Nuclear Charge-Nuclear Mass-Mass Spectroscopy-Mass Spectrometer- Theories of Nuclear Composition (proton-electron, proton-neutron)- Bound States of Two Nucleons-Spin States- Pauli's Exclusion Principle-Tensor Force-Static Force- Exchange Forces.

UNIT II	RADIOACTIVITY	12 hours

Alpha Decay: Properties of α Particles-Gamow's Theory of α Decay-Geiger Nuttal Law- α Ray Energies-Fine Structure of α Rays- α Disintegration Energy-Long Range α Particles. Beta Decay: Properties of β Particles-General Features of β Ray Spectrum- Pauli's Hypothesis - Fermi's Theory of β Decay – Forms of Interactions and Selection Rules - Gamma Decay: Absorption of γ Rays by Matter-Interaction of γ Rays with Matter- Measurement of γ Ray Energies-Internal Conversion.

UNIT III	NUCLEAR MODELS	12 hours

Liquid Drop Model: Bohr Wheeler Theory of Fission-Condition for Spontaneous Fission- Activation Energy. Shell Model: Explanation of Magic Numbers-Prediction of Shell Model Prediction of Nuclear Spin and Parity-Nuclear Statistics-Magnetic Moment of Nuclei-Nuclear Isomerism - Collective Model: Explanation of Quadrupole Moments.

UNIT IV	NUCLEAR REACTIONS	12 hours

Kinds of Reactions and Conservation Laws-Energy of Nuclear Reaction-Iso Spin- Continuum Theory of Nuclear Reactions-Resonance-Breit and Wigner Dispersion Formula - Stages of a Nuclear Reaction- Statistical Theory of Nuclear Reactions-Kinematics of Stripping and Pickup Reaction.

UNIT V	PARTICLE PHYSICS	12 hours

Leptons-Hadrons-Mesons-Hyperons – Pions - Mesons, Resonances- Strange Mesons and Baryons-Gell-Mann Okuba Mass formula for Baryons - CP Violation in Neutral Kaon (K0) Decay- Symmetry and Conversion Laws-Quark Model-Reaction and Decays.

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars	
Total Lecture Hours	60 hours
Text Book(s) for Study	
1	Nuclear and Particle Physics-Pandya and Yadav
2	Nuclear Physics-J.C. Tayal –Umesh Prakashan- Gujarat
Text Book(s) for Reference	
1	Nuclear Physics- D.C. Sharma-K. Nath & Co-Meerut1600
2	Concepts of Nuclear Physics-Bernard L. Cohen-Tata McGraw Hill- New Delhi 1600,1978
3	Introductory Nuclear Physics-Kenneth S. Krane-John Wiley & Sons
4	Physics of Nucleus and Particles-Volume I& II-B. Nermeir & Sheldon
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/115/104/115104043/
2	https://nptel.ac.in/courses/115/106/115106087/
3	https://nptel.ac.in/courses/115/103/115103101/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 43B	Core Paper XII	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ATOMIC & MOLECULAR SPECTROSCOPY	5	0	0	4
		SEMESTER IV			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to learn the fundamentals of Spectroscopy and the various experimental techniques employed to study matter at the microscopic levels.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Get familiarity with the basic concepts of electromagnetic radiation and its quantization	K1
2	Understand, analyze and evaluate different spectral lines arising from atoms and the interaction as well as measurement of emitted spectral lines.	K2,K3, K4
3	Evaluate different spectroscopic tools and techniques to analyze molecular structure, vibrational and rotational motion modes of the molecules and evaluate corresponding energy transitions	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	ATOMIC & MICROWAVE SPECTROSCOPY	10 hours

Atomic Spectroscopy – Spectra of Alkali Metal Vapors – Normal & Anomalous Zeeman Effect –Magnetic Moment of Atom and the G Factor – Lande's 'g' Formula – Paschen Back Effect – Hyperfine Structure of Spectral Lines Microwave Spectroscopy – Experimental Methods – Theory of Microwave Spectra of Linear, Symmetric Top Molecules – Hyperfine Structure – Quadrupole Moment – Inversion Spectrum of Ammonia

Unit II	INFRARED & RAMAN SPECTROSCOPY	12 hours

IR Spectroscopy: Practical Aspects–Theory of IR Rotation Vibration Spectra of Gaseous Diatomic Molecules - Applications–Basic Principles of FTIR Spectroscopy-Raman Spectroscopy: Classical and Quantum Theory–Rotation Vibration Raman Spectra of Diatomic and Polyatomic Molecules–Applications–Laser Raman Spectroscopy

Unit III	ELECTRONIC SPECTRA: FLUORESCENCE & PHOSPHORESCENCE SPECTROSCOPY	12 hours

Excitation of Diatomic Species – Vibrational Analysis of Band Systems of Diatomic Molecules – Deslandre's Table – Intensity Distribution – Franck Condon Principle – Rotational Structure of Electronic Bands – Resonance and Normal Fluorescence – Intensities of Transitions – Phosphorescence – Population of Triplet State and Intensity –Experimental Methods – Applications of Fluorescence and Phosphorescence

Unit IV	NMR & NQR SPECTROSCOPY	12 hours

NMR Spectroscopy: Quantum Mechanical and Classical Description - Bloch Equations - Relaxation Processes - Experimental Technique - Principle and Working of High Resolution NMR Spectrometer - Chemical Shift - NQR Spectroscopy: Fundamental Requirements - General Principle - Experimental Detection of NQR Frequencies – Interpretation and Chemical Explanation of NQR Spectroscopy.

Unit V	ESR & MOSSBAUER SPECTROSCOPY	12 hours

ESR Spectroscopy: Basic Principles-Experiments – ESR Spectrometer-Reflection Cavity and Microwave Bridge – ESR Spectrum – Hyperfine Structure - Mossbauer Spectroscopy: Mossbauer Effect – Recoilless Emission and Absorption – Mossbauer Spectrum - Experimental Methods - Hyperfine Interaction - Chemical Isomer Shift - Magnetic Hyperfine and Electric Quadrupole Interaction

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars

Total Lecture Hours		60 hours
Text Book(s)		
1	Molecular Structure and Spectroscopy – G. Aruldhas	
2	Introduction to Atomic Spectra – H. E. White, McGraw-Hill Inc., US (1934).	
Reference Books		
1	Spectroscopy: Volumes I, II and III - B.P. Straugham & S. Walker	
2	Fundamental of molecular spectroscopy – C. B. Banwell	
3	Introduction to molecular spectroscopy – G. M. Barrow	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://nptel.ac.in/courses/115/105/115105100/	
2	https://onlinecourses.nptel.ac.in/noc20_cy31/preview	
Course Designed By: BOS-PHYSICS-PG-Team		

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 43C	Core Paper XIII	L	T	P	C	P
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	LASER OPTICS	5	0	0	4	0
		SEMESTER IV				
		Syllabus Version 2026-2027				

Course Objectives:

The main objectives of this course is to learn the basics of Lasers, its properties, characteristics and its various applications.

Expected Course Outcomes:

1) On the successful completion of the course, student will be able to:
2) Understand the process of optical amplification and get familiarized with the properties of different types of lasers and its operation K2
3) Apply the theoretical concepts of laser optics for industrial purposes K2
4) Explore the significance of Surface Plasmons in optical phenomena and its applications K3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

Unit I	LASERS – FUNDAMENTALS AND TYPES	10 hours

Basic Construction and Principle of Lasing –Einstein Relations and Gain Coefficient –Creation of a Population Inversion – Three Level System–Four Level System –Threshold Gain Coefficient for Lasing – Laser types: He Ne – CO2 Laser – Nd:YAG Laser – Semiconductor Laser

Unit II	LASER OPERATION	8 hours

Optical Resonator- Laser Modes- Axial & Transverse modes- Modification in Basic Laser Structure- Basic Principle of Mode Locking- Active & Passive Mode Locking- Q Switching- Pulse Shaping-application of lasers in SMILE surgery.

Unit III	LASER BEAM CHARACTERISTICS	12 hours

Introduction to Gaussian Beam-width-Divergence-Radius of Curvature-Rayleigh Range-Guoy Phase –formulation of ABCD matrix method –ABCD matrix of some optical system-ABCD Law for Gaussian Beam-The Complex Radius of Curvature.

Unit IV	FOCUSING OF LASER BEAM	14 hours

Diffraction- limited spot size-tight focusing of light - angular spectrum representation of optical near field-aplanatic lens-Focusing of higher-order laser modes-Radially polarized doughnut mode-Azimuthally polarized doughnut mode-applications-near field optical recording-optical tweezers- STED microscopy

Unit V	SURFACE PLASMONS	14 hours

Introduction-Optical properties of noble metals- Drude–Sommerfeld theory- Surface Plasmon polaritons at plane interfaces- Properties of surface plasmon polaritons- Excitation of surface plasmon polaritons by Kretschmann Configuration – Otto's Configuration - Optical Fiber Method - Applications of Surface Plasmon Sensors

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars

Total Lecture Hours	60 hours

Text Book(s)

S. No	Authors	Title of the Book	Publishers & Edition
1	An Introduction to Lasers Theory & Applications	Dr. M.N. Avadhanulu Dr. P.S. Hemne	S. Chand (2012) 2nd edition
2	Nano materials: Processing and Characterization with Lasers	Subhash Chandra Singh,Haibo Zeng, Chunlei Guo and Weiping, Cai,	Wiley-VCH Verlag.(2012) 1st edition
3	Principles of Nanooptics	L. Novotny and B. Hecht	Cambridge Univ Press (2016-I Edition)

Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Principles of lasers	Orazio Svelto	Springer	2008
2	Solid state Laser Engineering	Walter Koechner	Springer	2006
3	Lasers and NonlinearOptics	B.B. Laud	New Age International (P)	2011
4	Fundamentals ofPhotonics	Bahaa E. A.Saleh, Malvin Carl Teich	John Wiley & Sons, Inc.,	1995
5	Encyclopedia of Optical Engineering	R. G. Driggers, C.Hoffman Marcel Dekker	Springer	2003
6	Laser Material Processing	W.M. Steen, J. Mazumder	Springer	2010

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]

1	https://nptel.ac.in/courses/115/101/115101008/
2	https://spie.org/education/courses/coursedetail/SC047?f=InCompany
3	https://ipenche.chania.teicrete.gr/an-introduction-to-laser-physics-and-systems/

Course Designed By: BOS-PHYSICS-PG-Team

Mapping with Programme outcomes
(S – Strong; M – Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 43P	Practical - VII	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	**ADVANCED PHYSICS LAB – II** (Examination of 6 Hours Duration at the end of Fourth Semester)	0	0	5	4
		SEMESTER IV			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Develop experimental physics skills and analyze the results with theoretical calculations.	K2
2	Utilize Computational Mat Lab & Python Programing skills in problem solving and data representation	K3
3	Become a skillful experimental physicist	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S. No.	LIST OF EXPERIMENTS (Any SIX Experiments)
1	Hall Effect - Determination of Hall Coefficient
2	Measurement of Conductivity - Four probe method
3	Thermal Conductivity-Forbes's Method.
4	Electronic Specific Charge e/m by Thomson's Method
5	Determination of Planck Constant - LED Method
6	Determination of Conductance of photoconductor, photovoltaic cell (solar cell) and photodiode
7	Determination of Wavelength, Separation of wavelengths - Michelson Interferometer
8	He Ne Laser- Determination of Diffraction pattern of light with circular aperture using Diode/He-Ne laser
9	Mat Lab Programming-Solution of Ordinary Differential Equations-2"" Order
10	Mat Lab Programming-Computer Simulation of Kronig-Penney Model
11	Mat Lab Programming-Numerical Integration
12	Python Programming: Radioactive Decay
13	Python Programming: Wave function of a Harmonic Oscillator
14	Python Programming : Simulation of Particle in a Box
15	Python Programming: Simulation of a Simple Pendulum

Course Designed By: BOS-PHYSICS-PG-Team

Course code : 43Q	Practical - VIII	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	**ADVANCED ELECTRONICS LAB – II** (Examination of 6 Hours Duration at the end of Fourth Semester)	0	0	5	4
		SEMESTER IV			
		Syllabus Version 2026-2027			

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Utilize operational amplifiers/Microprocessors/Microcontrollers to build circuits to carry out various tasks and construct multi-purpose electronic devices	K4
2	Design and develop electronic circuits as well as test/troubleshoot the functioning of these circuits	K5
3	Become a skilful circuit Designer and thus enhance his employability/entrepreneurial skills	K3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

S. No.	LIST OF EXPERIMENTS (Any Six Experiments)
1	Op-Amp: Instrumentation Amplifier-Light Intensity-Inverse Square Law
2	Op-Amp: Analog Computation-Second Order Differential Equation
3	Op-Amp Comparator-Zero Crossing Detector, Window Detector, Time Marker
4	Op-Amp: Digital to analog converter
5	IC 555 Timer Application-Monostable and Astable Multivibrators
6	IC Counters with Feedback
7	Microprocessor : Traffic Signal Simulation
8	Microprocessor: Hex Keyboard Interfacing
9	Microcontroller: triangle wave generator
10	Python Programming: Simulation of the Electric Field of a Capacitor
11	Python Programming: Half Wave & Full Wave Rectifier
12	Python Programming: Op-Amp Inverting & Non-Inverting Amplifier
13	Python Programming: Simulate and plot the Characteristics of a Zener Diode
14	Python Programming: Simulation of an AC Coupled Amplifier using NPN Bipolar Transistor

Course Designed By: BOS-PHYSICS-PG-Team

Course code : 47R	Technical Skills Enhancement Programme	L	T	P	C
Pre-requisite English Writing, Reading & Speaking Skills With Basic Physics Knowledge	(Self-Study Course with Presentation Only and No Examination at the End of Fourth Semester)	0	0	2	1
		SEMESTER IV			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to enhance the student's verbal, written and oral communication skills and thus make them empowered to meet any challenges and situations thereby increase their employability and technical communication/entrepreneurial skills. This course is offered as a stand-alone compulsory self-study course with end of semester Presentation/Viva-voce only and no written examination.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get Familiarized with necessary skills spectrum required in today's competitive world scenario	K2
2	Develop unique technical skills and be able to communicate the same effectively and coherently	K4
3	Get themselves ready for exposure to various jobs/careers and attract the attention of employer	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I	INTRODUCTORY ACTIVITIES	8 hours

Listening Skills-Definition - Types - Tips for effective listening - Academic & Technical listening-Listening to talks and presentations - Listening to announcements -Listening to radio and television- Effective listening and English-Activities. Writing Skills: Standard business letter -Report writing-Email drafting and Etiquette -Preparing agenda and writing minutes - Making notes on business conversations-Effective use of SMS-Case studies and documentation-Technical & Scientific Writing

Unit II	7QC TOOLS	4 hours

Flow diagram - types - Applications - Brain storming -- Key elements - Methods - Uses - Data Collection - Purpose - Types of Data - Check Sheet - Interpretation - Errors in interpretation - Benefits of Data Collection - Graphs - Purpose - Types – Benefits.

Unit III	DATA REPRESENTATION & INTREPRETATION	6 hours

Stratifications - Steps for stratification - Source and Bases - Pareto Diagram - Principles for selection - Uses of Pareto Analysis - Pit falls - Cause and Effect Diagram - Making of cause and effect Diagram - Types of cause and effect diagram - Scatter Diagram - Making of Scatter Diagram - Pit falls - Need for a good scatter diagram - Histogram - Construction of Histogram Interpretation and Shapes of Histogram- Uses of Histogram - control Chart -Types - Making of control charts – Interpretation.

Unit IV	QUANTITATIVE & TECHNICAL APTITUDE	4 hours

- Problems on numbers - Ages - Time and Work -Calendar - Odd-man-out and series-Verbal Reasoning: Series completion analogy - Puzzle Test - Logical Sequence of words - Non-verbal reasoning: Figure formation

Unit V	COMPUTERS	6 hours

Basics of Computers - Email - MS Word - MS Excel Power point presentation - other technical software's useful for science students.

Books for Study & Reference :

1. Communication Skills - A Multi-skill Course, Course Team, Bharathiar University, Macmillan Publisher India Limited, Delhi, Reprint 2011(Unit 1).
2. Problem Solving Techniques by K. Ganapathy, V. Narayana and B. Subramaniam, Quality circle forum of India, Revised Edition 2003 (Unit 2 & 3).
3. Verbal Reasoning by R. S. Aggawal, S. Chand & Co., New Delhi (Unit 4).
4. Basic Computers (Unit 5).

Course Designed By: BOS-PHYSICS-PG-Team

Course code : 1EA	Elective I	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	NON-CONVENTIONAL ENERGY RESOURCES	5	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to learn about alternative energy resources and their important applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1)	Get familiarized with various renewable energy technologies	K2
2)	Understand characteristics of solar radiation and solar energy devices	K3
3)	Learn about geothermal energy and fuel cells	K3
4)	Explore Wind Energy and Bio Mass Energy and its applications	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	INTRODUCTION TO NON-CONVENTIONAL ENERGY	10 hours

Introduction – Various non-conventional energy resources – Availability – Classification - Relative merits and Demerits Solar Cells - Theory of Solar Cells - Solar Cell Materials - Solar Cell Array - Solar Cell Power Plant - Limitations

Unit II	SOLAR THERMAL ENERGY	12 hours

Solar Thermal Energy - Solar radiation - Flat Plate Collectors and their Materials - Applications and Performance - focusing of Collectors and their Materials - Applications and Performance - Solar Thermal Power Plants - Thermal Energy Storage for Solar Heating and Cooling - Limitations

Unit III	GEOTHERMAL ENERGY AND FUEL CELLS	12 hours

Geothermal Energy - Resources of Geothermal Energy - Thermodynamics of Geo Thermal Energy Conversion - Electrical Conversion – Non electrical Conversion - Environmental Considerations - Magneto Hydrodynamics (MHD) - Principle of Working of MHD Power Plant - Performance and Limitations – Fuel Cells - Principle of Working of Various Types of Fuel Cells and their Working - Performance and Limitations

Unit IV	WIND ENERGY AND POWER GENERATION	12 hours

Wind Power and its Sources - Site Selection – Criterion - Momentum Theory - Classification of Rotors - Concentrations and Augments - Wind Characteristics - Performance and Limitations of Energy Conversion Systems

Unit V	BIO MASS	12 hours

Bio mass - Availability of Bio mass and its Conversion Theory - Ocean Thermal Energy Conversion (OTEC) - Availability - Theory and Working Principle - Performance and Limitations - Wave and Tidal Wave - Principle of Working - performance and Limitations.

Unit VI	CONTEMPORARY ISSUES	02 hours

Expert lectures, online seminars - webinars

Total Lecture hours	60 hours

Text Book(s)

1	Introduction to Non-Conventional Energy Resources Raja et.al, SciTech Publications
2	Non-conventional Energy Resources -D.S. Chauhan, New Age International

Reference Books	
1	Renewal Energy Resources - John Twideu and Tony Weir, BSP Publications, 2006
2	Energy Resources: Conventional & Non-Conventional - M.V.R. Koteswara Rao, BSP Publications, 2006.
3.	Renewal Energy Technologies: A Practical Guide for Beginners C.S. Solanki-PHI Learning

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1 https://nptel.ac.in/courses/121/106/121106014/
2 https://onlinecourses.nptel.ac.in/noc20 ge06/preview
3. https://nptel.ac.in/courses/103/107/103107157/

Course Designed By: BOS-PHYSICS-PG-Team

Mapping with Programme outcomes

S - Strong; M - Medium; L – Low

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 1EB	ELECTIVE I	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	NANO-SCIENCE & NANOTECHNOLOGY	5	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to learn about the basics of Nano-science & Nano-technology & its applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1) Understand the fundamentals properties of Nano-materials/ quantum dots/Wells/Wires
2) Analyze the morphology and size of the nanoparticles using various analytical techniques
3) Evaluate the potential applications of Nano-materials
4) Understand different methods of synthesis of nanomaterials using various physical, chemical and biological approaches

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	OVERVIEW OF NANO-SCIENCE	10 hours

Definition of Nano, Nano revolution of the 20th century – emergence and challenges of nano-science and nano-technology- Atomic Structure and atomic size, - large surface to volume ratio, surface effects on the properties.

Unit II	DIFFERENT CLASSES OF NANO-MATERIALS	12 hours

One dimensional, Two dimensional and Three dimensional nanostructured materials. Quantum dots, Wells and Wires - Bucky Balls and Carbon Nanotubes.

Unit III	SYNTHESIS OF NANO-MATERIALS	12 hours

Top down (Nanolithography, CVD, PVD, Ball milling) – bottom up (sol gel processing, chemical deposition, Spin coating, spray pyrolysis)

Unit IV	CHARACTERIZATION	12 hours

Powder X-ray diffraction - Debye-Scherrer technique - Indexing the powder pattern - Calculation of particle size using Scherer method - Lattice constant calculations. Microscopic Analysis: Scanning Electron Microscope (SEM) - EDAX analysis - Principle of Transmission Electron Microscopy (TEM).

Unit V	APPLICATIONS	12 hours

Carbon Nanotubes for energy storage – Nano-materials in waste water treatment- catalytic process - Dye-sensitized solar cells- Biosensors – Gas sensor and its types.

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars - Webinars

	Total Lecture Hours	60 hours

Text Book(s)

1	Nano-crystals: Synthesis, Properties and Applications - C.N.R. Rao, P.J. Thomas and G.U. Kulkarni, Springer (2007)
2	Nanostructured Materials and Nanotechnology - Hari Singh Nalwa, Academic Press, 2002

Reference Books

1	Energy for a sustainable world by L. Freris, D. Infield, Wiley, 2008.

2	Nano-materials for Sustainable Energy by Quan (Ed.), Springer, 2016.
3	Nano-materials in Energy Devices by Jun Hieng Kait CRC Press, 2017.
4	Advanced nano-materials and their applications in renewable energy by J. Louise, L. S. Bashir, 2015.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	http://www.ncpre.iitb.ac.in/slotbooking/SOP/62SOP.pdf
2	https://en.wikipedia.org/wiki/Nanomaterials
3	https://www.nano.gov/you/nanotechnology-benefit
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes

(S - Strong; M - Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 1EC	ELECTIVE I	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	INDUSTRY (4.0)- ROBOTICS, ARTIFICIAL INTELLIGENCE & INFORMATION THEORY	5	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to become aware of the fundamentals of Robotics, Artificial Intelligence and Programming Electronics through Ardunio IDE.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1	Understand & acquire basics of robotics/robotic sensors/artificial intelligence	K2
3	Comprehend & Implement the basics of cyber security and hacking and interfacing between experiments and Ardunio IDE	K3 K5
5	Familiarize with the basics of classical and quantum computers	K2

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	BASICS OF ROBOTICS	12 hours

Robot – Definition of Robot – Industrial Robot – Laws of Robotics – Motivating Factors – Advantages and Disadvantages of Robots – Characteristics & Components of an Industrial Robot –– Comparison of the Human and Robot Manipulator – Robot Wrist and End of Arm Tools – Robot Terminology – Robotic Joints – Classification of Robots –Classification on the Basis of Coordinate System, Power Source and Method of Control - Robot Selection – Robot Work cell – Robotics and Machine Vision – Robotic Accidents , Safety, Maintenance and Installation – Robotic Sensors – Types of Sensors in Robots – Exteroceptors – Tactile Sensors – Proximity Sensors – Range Sensors – Machine Vision Sensors – Velocity Sensors – Proprioceptors .

Unit II	ARTIFICIAL INTELLIGENCE	10 hours

Introduction to Artificial Intelligence (AI) – Need for AI – Applications domains of AI – tools – Challenges and Future of AI – Fundamentals of Machine Learning and Deep Learning – Machine Learning algorithms to find associations across Biological Data, Cellular Image Classification and Identification of Genetic Variations – AI in Bio Physics Research – AI in drug Design – AI in next generation Sequencing – AI in Protein Structure – AI in Protein Folding Analysis

Unit III	BASICS OF CYBER SECURITY AND ETHICAL HACKING	12 hours

Cyber Security - Security Environment – Threats – Cyber Crime – Vulnerabilities in Software – Open Access Data – Open Source Software – Ethical Hacking – Hacker and Cracker – Computer Fraud – Malware Threats – Viruses and Worms – Trojans – Spyware – Malware Counter Measures – Ethical and Legality

Unit IV	PROGRAMMING BASICS WITH C USING ARDUNIO IDE, SENSORS AND ACTUATORS	12 hours

Installing and Setting up the Arduino IDE – Basic Syntax – Data Types / Variables / Constant – Operators-Conditional Statements and Loops – Using Arduino C Library Functions for Serial, Delay and Other Invoking Functions – Strings and Mathematics Library Functions – Basics of Analog and Digital Sensors – Interfacing Temperature Sensors, Ultrasound Sensor, Infrared Sensor, LED and Buzzer with Arduino – Introduction to ESP8266 NODEMCU Wifi Module – Basic knowledge of Programming NODEMCU using Arduino IDE

Unit V	INFORMATION THEORY	12 hours

Classical Information Theory – Classical Bits - Classical Computers – Classical Turing Machine – von Neumann Computer – Classical Logic Gates and Logic Circuits – Quantum Information Theory – Quantum Bits (Qbits) – Superposition Principle – Collapse of Wave function – EPR Paradox – Bell's inequality with proof – Quantum Turning Machine – Quantum Gates - Basics of Quantum Teleportation and Cryptography

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars – Webinars	
Total Lecture Hours	60 hours
Text Book(s)	
1	Industrial Automation and Robotics – A. K. Gupta, S. K. Arora and J. R. Westcott, Mercury Learning and Information LLC, 2017
2	Arduino Cookbook – Michael Margolis, O' Reilly Media, Inc., 2011
3	Artificial Intelligence: A modern approach – Stuart Russell and Peter Norvig, Prentice Hall, 3rd Edition, 2009
Reference Books	
1	Principles of Information Security – Michael E Whitman and Herbert J Mattord, Vikas Publishing House, 4th Edition, 2011
2	Ethical Hacking: A Beginners Guide to Learning the World of Ethical Hacking – Lakshay Eshan, Shockwave Publishing, 2018
3	Quantum Computation and Quantum Information – Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press, 2000
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/106105166/
2	http://www.theory.caltech.edu/people/preskill/ph229/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme Outcomes (S - Strong; M - Medium; L – Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	L	S	S
CO2	S	M	S	L	L	M	M
CO3	S	M	S	L	M	M	M
CO4	S	M	S	S	M	S	S
CO5	S	M	S	L	M	M	M

Course code : 2EA	ELECTIVE II	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	ATMOSPHERIC PHYSICS	4	0	0	4
		SEMESTER I			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to study the microphysical processes in the Earth's Atmosphere with application to meteorology, climatology, remote sensing and the environment.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Acquire knowledge about Earth's composition, structure and Physical phenomena	K2
2	Understand radar meteorology and it's applications	K3
3	Explore information about clouds, their types, precipitation and Global Energy Balance	K4
4	Become aware of the menace of Atmospheric Pollution and methods to control it.	K5
5	Create a scope to identify new areas of research in the field of atmospheric science	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I PHYSICAL METEOROLOGY 12 hours

Physical Meteorology: Structure of Earth's Atmosphere and Composition - Law of Thermodynamics of the Atmosphere - Adiabatic Process - Potential Temperature - Clausius Clapyeron Equation - Laws of Black Body Radiation - Solar and Terrestrial Radiation – Albedo - Green House Effect - Heat Balance of Earth Atmosphere System

Unit II DYNAMIC METEOROLOGY 10 hours

Fundamental Forces - Structure of Static Atmosphere - Momentum, Continuity and Energy Equations Thermodynamics of the Dry Atmosphere - Elementary Applications of the Basic Equations - Circulation Theorem – Vorticity - Potential Vorticity and Potential Vorticity Equations

Unit III CLIMATE & MONSOON DYNAMICS 12 hours

Climate Classification - Polar, Artic, Antarctic, Temperate & Tropical Climates Wind, Temperature & Pressure Distribution over India in the Lower, Middle and Upper Atmosphere during Pre – Post - and Mid - Monsoon Season - Dynamics of Monsoon Depression and Easterly Waves - Intra Seasonal and Inter annual Variability of Monsoon – Quasi Bi Weekly and 30 - 60 Day Oscillations - Walker Circulation, Southern Oscillations & El Nino.

Unit IV ATMOSPHERIC POLLUTION 12 hours

Role of Meteorology in Atmospheric Pollution - Atmospheric Boundary Layer - Air Stability - Local Wind Structure - Ekman Spiral - Turbulence & Boundary Layer Scaling - Residence Time and Reaction Rates of Pollutants - Sulphur Compounds - Carbon Compounds - Organic compounds –Aerosols - Toxic Gases and Radio Active Particles - Trace Gases

Unit V RADAR METEOROLOGY 12 hours

Basic Meteorology - Radar Principles and Technology - Radar Signal Processing & Display -Weather Radar - Observation of Precipitating Systems - Estimation of Precipitation - Radar observation of Tropical Storms & Cyclones - Use of Weather Radar in Aviation - Clear Air Radars - Observation of a Clear Air Phenomena.

Unit VI CONTEMPORARY ISSUES 2 hours

Expert Lectures, Online Seminars - Webinars

Total Lecture Hours 60 hours

Text Book(s)	
1	The Atmosphere - Frederick K. Lutgens and Edward J. Tarbuk
2	Dynamic Meteorology - J.R. Holton, Academic Press NY
Reference Books	
1	The Physics of Monsoons - R.N. Keshvamurthy & M. Shankar Rao, Allied Publishers
2	Principles of Air Pollution Meteorology –Tom Lyons & Prillscott, CBS Publishers & Distributors
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://nptel.ac.in/courses/119/106/119106008/
2	https://nptel.ac.in/courses/119/102/119102007/
3	https://nptel.ac.in/courses/119/108/119108004/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 2EB	ELECTIVE II	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	CRYSTAL GROWTH METHODS AND CHARACTERIZATION	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to provide students information about Crystal Structure, various synthesis methods and subsequent characterization for applications purpose.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1)	Understand the process of crystal nucleation and growth	K2
2)	Acquire knowledge about various crystal growing techniques	K3
3)	Analyze the methodologies of solution/gel growth/ melt and vapour growth techniques for specific purposes	K2, K3
4)	Become aware of different crystal characterization techniques available	K4, K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I	NUCLEATION THEORY	10 hours

Importance of crystal growth –Classification of crystal growth methods –Nucleation Theory - Kinds of nucleation – Homogeneous nucleation - Heterogeneous nucleation - secondary nucleation -Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation –Energy of formation of a spherical nucleus and cylindrical nucleus.

Unit II	SOLUTION GROWTH TECHNIQUES	12 hours

Growth from low temperature solutions - Selection of solvents and solubility – Meir's solubility diagram – Saturation and Super saturation – Metastable zone width – Growth by restricted evaporation of solvent, slow cooling of solution and temperature gradient methods - Gel Growth Technique - Principle – Various types – Structure of gel – Importance of gel – Experimental procedure – Chemical reaction method – Single and double diffusion method – Chemical reduction method – Complex and de complexion method – Advantages of gel method - Growth from high temperature solutions - Flux growth – Hydrothermal growth method

Unit III	MELT GROWTH TECHNIQUES	12 hours

Basics of melt growth - Bridgman method – Growth apparatus - Crucibles, Heater, Measurement and Control of Temperature – growth process – Applications of Bridgman method - Czochralski technique – Growth apparatus – seed preparation – pulling rate – shape of crystal melt interface – Growth process

Unit IV	VAPOUR GROWTH TECHNIQUES	12 hours

Physical Vapour Transport (PVT) – Processes of sublimation and condensation principle – crystal growth in closed and semi open ampoules – Chemical Vapour Transport – Criteria for the choice of transport reaction – Transported materials and transporting agents – Temperature variation method for crystal growth - Stationary temperature profile - Linearly time varying temperature profile and Oscillatory temperature profile

Unit V	CHARACTERIZATION TECHNIQUES	12 hours

X Ray Diffraction (XRD) –Powder and single crystal –UV Visible - Fourier Transform Infrared (FT- IR) and Raman spectroscopic analysis –TG DTA/DSC Thermal Analysis - Vickers Micro hardness - Chemical Etching.

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars - Webinars

	Total Lecture Hours	60 hours
Text Book(s)		
1	J. C. Brice, Crystal Growth Processes, John Wiley and Sons, New York, 1986.	
2	P. Santhana Ragavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam, 2001.	
3	H.L. Bhat, Introduction to Crystal Growth Principles and Practice CRC Press, Taylor & Francis Group, Boca Raton, Florida, 2015.	
Reference Books		
1	Govindhan Dhanaraj, Kullaiah Byrappa, Vishwanath Prasad, Michael Dudley (Eds.), Hand book of Crystal Growth Springer Heidelberg Dordrecht London New York, 2010.	
2	B.R. Pamplin, Crystal Growth, Pergamon Press, Oxford, 1975.	
3	K. Sangwal, Elementary Crystal Growth (Edited), SAAN Publishers, Lublin, 1994.	
4	Sam Zhang, Lin Ki, Ashok Kumar, Materials Characterization Techniques, CRC Press, Taylor & Francis Group, Boca Raton, Florida, 2009.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://nptel.ac.in/courses/113/105/113105025/	
2	https://nptel.ac.in/courses/104/104/104104011/	
3	https://onlinecourses.nptel.ac.in/noc19_cy35/preview	
Course Designed By: BOS-PHYSICS-PG-Team		

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 2EC	ELECTIVE II	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	INTRODUCTION TO DATA ANALYTICS	4	0	0	4
		SEMESTER II			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to provide information about data terminologies related to Big Data, AI, ML and related fields

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1) After completing this course, the student will be able to understand the various data terminologies	K1-K5
2) Understand the importance of data science	K1-K5
3) The concepts of Big data and related aspects	K1-K5
4) The potential of Big data in AI and ML and other fields	K1-K5
5) To know about various applications of Big Data field	K1-K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I	DATA TERMINOLOGIES	12 hours

Introduction – Data – Information – Data Terminologies – Database – Data Mining – Data Warehouse – Data Evolution Roadmap – Big Data – Definition – Type of Data - Numeric– Categorical – Graphical – High Dimensional Data –– Data Classification – Hot Data –Cold Data – Warm Data – Thick Data – Thin Data - Classification of digital Data: Structured, Semi-Structured and Un-Structured

Unit II	DATA SCIENCE	12 hours

Data Science: Data Science-A Discipline – Data Science vs. Statistics, Data Science vs. Mathematics, Data Science vs. Programming Language, Data Science vs. Database, Data Science vs. Machine Learning. Data Analytics - – Relation: Data Science, Analytics, Big Data Analytics. Data Science Components: Data Engineering, Data Analytics-Methods and Algorithm, Data Visualization.

Unit III	BIG DATA CONCEPTS	12 hours

Big Data: Digital Data-an Imprint: Evolution of Big Data – What is Big Data – Sources of Big Data. Characteristics of Big Data Vs – Big Data Myths - Data Discovery-Traditional Approach, Big Data Technology: Technology Process – Big Data Exploration -Data Augmentation – Operational Analysis – 360 View of Customers – Security and Intelligence.

Unit IV	BIG DATA POTENTIALS	12 hours

Big Data Technology Potentials – AI – Machine Learning – Cloud Computing – Mobile Communication – IoT – Big Data in Industry 4.0- Big Data Platforms – HADOOP –SQL Databases - Types - Big Data Challenges.

Unit V	APPLICATIONS OF BIG DATA	10 hours

Big Data Use Cases –- Big Data Roles Data Scientist , Data Architect, Data Analyst – Skills – Case Study : Big Data – Customer Insights – Behavioral Analysis – Big Data Industry Applications - Marketing – Retails – Insurance – Risk and Security – Health care

Unit VI	CONTEMPORARY ISSUES	2 hours
Expert Lectures, Online Seminars - Webinars		
	Total Lecture Hours	60 hours

Text Book(s)	
1	V. Bhuvaneswari, T. Devi, "Big Data Analytics: Scitech Publisher , 2018
2	Han Hu, Yonggang Wen, Tat-Seng, Chua, XuelongLi,"Toward Scalable Systems for Big Data Analytics: A Technology Tutorial", IEEE, 2014.
Reference Books	
1	Big Data Analytics, Radha Shankarmani, M. Vijayalakshmi, Wiley, 2nd Edition (2016)
2	Big Data Analytics, Venkat Ankam, Packt Publicatins, (2016)
3	Massive Big-Data problems • https://www.forbes.com/sites/bernardmarr/2017/06/15/3-massive-big-data-problemseveryone-should-know-about/#160a339b6186
4	Big-data analytics: Challenges and Implementation • https://www.hiddenbrains.com/blog/big-data-analytics-challengesimplementation.html
Related Online Contents **[MOOC, SWAYAM, NPTEL, Websites, etc.]**	
1	https://ocw.mit.edu/resources/res-ll-005-mathematics-of-big-data-and-machinelearning-january -iap-2020/
2	https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3	https://onlinecourses.swayam2.ac.in/arp19_ap60/preview
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 3EA	ELECTIVE III	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	EXPERIMENTAL DATA TECHNIQUES AND ANALYSIS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to:

1. Get acquainted with the concept of errors.
2. Explore the constructions and working principle of sensors and transducers.
3. Recognize the measurable parameters in electronic instruments.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1) Acquire experiential knowledge for experimental research design	K5
2) Become aware of experimental limitations	K6
3) Apply experimental knowledge for interpreting the test results accurately	K3
4) Propose an appropriate statistical model for a given dataset and interpret the goodness of fit	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I	INTRODUCTION	12 hours

Introduction - Measurement of errors: accuracy, precision, resolution, sensitivity - absolute and relative errors - Types of errors - gross error, systematic error and random error- standards of measurements - classification of standards, time and frequency standards, electrical standards.

Unit II	ELECTRICAL TRANSDUCER CLASSIFICATION	10 hours

Active and Passive transducers - resistive, inductive, capacitive, thermocouple and Piezoelectric transducers - Digital transducers

Unit III	AMPLIFIERS AND SIGNAL CONDITIONING	12 hours

Instrumentation amplifiers - Isolation amplifiers - Chopper amplifiers - Voltage to frequency and voltage to current converters - Frequency multipliers - logarithmic amplifiers - S/H Circuits Active filters - Low pass, High pass, Band pass and Band stop filters

Unit IV	ANALYSIS	12 hours

Wave Analyzers - Audio frequency Wave analyzer - Heterodyne wave analyzer - Harmonic distortion analyzers - Resonant harmonic distortion analyzer - Heterodyne harmonic distortion analyzer - Fundamental suppression harmonic distortion analyzer - Spectrum analyzer - Spectra of CW, AM, FM and PM waves

Unit V	ELECTRONIC MEASURING INSTRUMENTS	12 hours

Q meter - Vector impedance meter - Digital frequency meter - Digital voltmeter - Phase meter- RF power and voltage measurement - Power factor meter - Vector voltmeter - Display and Recording: X-Y Recorders - Magnetic Tape recorders - Storage Oscilloscope

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars - Webinars

Total Lecture Hours	60 hours

Text Book(s)

1	Electrical & Electronics Measurement &Instrumentation - A. K. Sawhney

2	Electronic Instrumentation –H.S. Kalsi TMH
Reference Books	
1	Modern Electronic Instrumentation - W.D.Cooper
2	Instrumentation Devices and Systems - C.S. Rangan, G.R. Sharma and VSV Mani, Tata McGraw Hill Publications
3	Introduction to Instrumentation and Control - A.K. Ghosh - Prentice HallIndia Publications
4	Modern Electronic Instrumentation and Measurement Techniques - A.O. Hefnick and W.D. Cooper., Prentice Hall India Publications.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]	
1	https://onlinecourse.nptel.ac.in/noc19_ee38/preview
2	https://nptel.ac.in/courses/117/102/117102059/
3	https://www.udem.com/course/electronic-measurements-and-instrumentation/
Course Designed By: BOS-PHYSICS-PG-Team	

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

ourse code : 3EB	ELECTIVE III	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	MICROPROCESSORS & MICROCONTROLLERS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course are to:

1. To study the Architecture of µP8085 & µC8051
2. To study the addressing modes & instruction set of 8085 & 8051.
3. To introduce the need & use of Interrupt structure of 8085 & 8051.
4. To develop skill in simple applications development with programming 8085 & 8051

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1) Learn the instruction set of microprocessor	K5
2) Perform experiments using Intel 8051 microcontrollers and interface seven segment display, stepper motor control and traffic light control	K6
3) Identify architecture of microprocessor and microcontroller for use in instrumentation applications	K3
4) Acquire knowledge of the various peripheral devices of Intel 8051 for interfacing them	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit I	INTRODUCTION & INSTRUCTION SET OF 8085	10 hours

Pin Diagram – Architecture – De multiplexing the Bus – Generation of Control Signals – Fetching, Decoding and Execution of Instruction – Instruction set – Addressing modes – Instruction format – Memory Read Machine Cycle – Simple Programs

Unit II	INTERFACING CONCEPTS	12 hours

Peripheral I/O Instructions –Device Selection and Data Transfer – Input Interfacing –Parallel and Serial Interface - Introduction to Programmable Peripheral Interface 8255 –Pin Diagram –Architecture –Modes of Operation: I/O and BSR –Architecture and Operation of 8251 (USART) - 8085 Interrupts

Unit III	APPLICATIONS OF µP	12 hours

Time Delay Program –Traffic Light Control System –Water Level Controller –Stepper Motor Control – Interfacing DAC – Interfacing ADC –Temperature Measurement

Unit IV	INTRODUCTION & ASSEMBLY PROGRAMMING OF 8051	12 hours

Microcontrollers and Embedded Processors –Microcontrollers for Embedded Systems –Overview of 8051 Family –8051 Instruction Set and Registers - Introduction to 8051 Assembly Programming –the Program Counter and ROM –Data Types and Directives –Flag Bits and PSW Register –Register Bank and Stack –Loop and Jump Instructions –I/O Port Programming Addressing Modes –Simple Programs

Unit V	INTERFACING AND REAL TIME APPLICATIONS OF µC	12 hours

Interfacing LCD to the 8051 –Interfacing ADC –Interfacing Sensors to 8051 –Interfacing Stepper Motor – 8051 Interfacing to the Keyboard –Interfacing DAC to the 8051 - Real time applications

Unit VI	CONTEMPORARY ISSUES	2 hours

Expert Lectures, Online Seminars - Webinars

	Total Lecture Hours	60 hours
Text Book(s)		
1	Microprocessor Architecture, Program And Its Application With 8085 - R.S. Gaonkar, New Age International	
2	Microprocessor and Its Application - S. Malarvizhi, Anuradha Agencies Publications	
3	The 8051 Microcontroller And Embedded Systems Using Assembly And C - Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, PHI, 2nd Edition, 2006	
Reference Books		
1	The 8085 Microprocessor, Architecture, Programming and Interfacing –K Uday Kumar, S. Uma Shankar, Pearson	
2	Fundamentals of Microprocessors and Microcontrollers - B. Ram, Dhanpat Rai Publications	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://nptel.ac.in/courses/108/105/108105102/	
2	https://nptel.ac.in/courses/106/108/106108100/	
3	https://nptel.ac.in/courses/108/103/108103157/	
Course Designed By: BOS-PHYSICS-PG-Team		

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M

Course code : 3EC	ELECTIVE III	L	T	P	C
Pre-requisite B.Sc. Physics / B.Sc. Physics (CA)/ B.Sc. Applied Science	PROBLEMS IN PHYSICS	5	0	0	4
		SEMESTER III			
		Syllabus Version 2026-2027			

Course Objectives:

The main objectives of this course is to make the students are expected to possess fundamental knowledge in various branches of Physics and mathematical methods

1. Understand and solve problems in various branches of Physics.
2. Develop analytical and problem-solving skills in theoretical Physics.
3. Apply mathematical and computational techniques to Physics problems.

Expected Course Outcomes:

On successful completion of the course, the students will be able to :

1) Understand and analyze problems in core Physics subjects. K2
2) Apply mathematical techniques to solve Physics problems. K3
3) Develop advanced problem-solving approaches in modern Physics. K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit I	Quantum Mechanics and Statistical Physics (Solving CSIR, NET Problems from previous years Question Papers)	12 hours

Basics, TISE, 1D Box and LHO-Dirac Well and Scattering State Problems-Linear Algebra and Formalism-3D and Angular Momentum-Probability Distributions and Random Walk-Classical and Quantum Statistics-Thermodynamics

Unit II	Electrodynamics and Optics (Solving CSIR, NET Problems from previous years Question Papers)	12 hours

Vector Calculus-Electrostatics-Magnetostatics-Electrodynamics and Relativity-Relativity-Optics

Unit III	Classical and Mathematical Physics (Solving CSIR, NET Problems from previous years Question Papers)	12 hours

Lagrangian Dynamics-Central Force Problem-Hamiltonian Mechanics-Small Oscillation-Differential Equation-Fourier Series and Laplace Transform-Complex Analysis and Numerical Analysis

Unit IV	Atomic, Molecular and Nuclear Physics (Solving CSIR, NET Problems from previous years Question Papers)	12 hours

Fine Structure and Zeeman Effect-LASER related problems-Molecular Physics-Shell Model and Liquid Drop Model-Nuclear Decay and Scattering-Particle Physics.

Unit V	Condensed Matter Physics and Electronics (Solving CSIR, NET Problems from previous years Question Papers)	12 hours

Band Theory and Magnetism-Semiconductor Physics-Superconductivity-Crystallography and XRD-Diodes and Transistors-Op-Amp and Digital Electronics.

Unit VI	CONTEMPORARY ISSUES	2 hours
Expert Lectures, Online Seminars – Webinars		
	Total Lecture Hours	60 hours

Text Book(s)

1) Jeeva Jose & P. Sean Lal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Publishers, New Delhi, 2016
2) Mark Lutz, "Learning Python", 5th edition, Orelly Publication, 2013, ISBN 978- 1449355739
3) Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

Reference Books

Reference Books

Unit I – Quantum Mechanics and Statistical Physics

1. Introduction to Quantum Mechanics, David J. Griffiths and Darrell F. Schroeter, Cambridge University Press, 2018 (3rd Edition).
2. Fundamentals of Statistical and Thermal Physics, Frederick Reif, Waveland Press, 2009 (Reprint Edition).

Unit II – Electrodynamics and Optics

1. Introduction to Electrodynamics, David J. Griffiths, Cambridge University Press, 2017 (4th Edition).
2. Optics, Ajoy Ghatak, McGraw-Hill Education, 2012 (5th Edition).

Unit III – Classical and Mathematical Physics

1. Mathematical Methods in the Physical Sciences, Mary L. Boas, John Wiley & Sons, 2005 (3rd Edition).
2. Classical Mechanics, Herbert Goldstein, Charles Poole and John Safko, Pearson Education, 2002 (3rd Edition).

Unit IV – Atomic, Molecular and Nuclear Physics

1. Physics of Atoms and Molecules, B. H. Bransden and C. J. Joachain, Pearson Education, 2003 (2nd Edition).
2. Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons, 2022.

Unit V – Condensed Matter Physics and Electronics

1. Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons, 2004 (8th Edition).
2. Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson Education, 2013 (11th Edition).

Related Online Contents [Websites etc.]

https://snboseplc.com/topic-wise-previous-csir-net-gate-jest-tifr-iit-jam-physics-questions/

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Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	S	M
CO2	S	S	S	L	S	M	S
CO3	M	M	S	L	M	M	M
CO4	M	S	S	L	S	M	M
CO5	S	S	S	L	M	M	M